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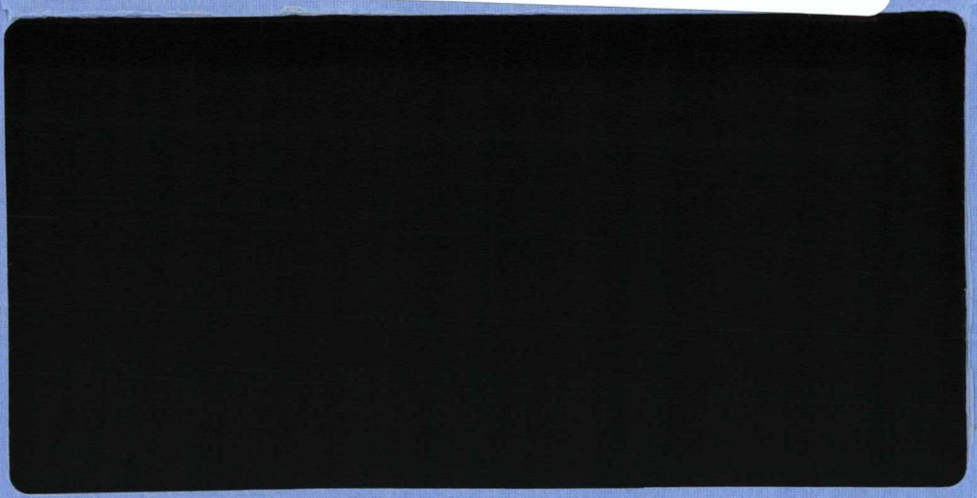

Sweet-Edwards / EMCON, Inc.

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CHEMICAL PROCESSORS, INC.
PIER 91 FACILITY

PROPOSAL FOR MONITORING, ANALYSES, AND TESTING

November 1988

Prepared for

U.S. Environmental Protection Agency
Region 10
Seattle, Washington

Prepared by

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Project No. S94-07.02

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PART A

SAMPLING PLAN

1.0 INTRODUCTION

This study is proposed to define the nature and extent of contamination in the soils and ground water beneath the Chemical Processors, Inc. (Chempro) facility at Pier 91, Seattle, Washington. The goal of the study is to complete the hydrogeologic site characterization on Pier 91 initiated in a Phase I investigation. A second goal of the study is to develop the data and monitoring system needed for a RCRA Part B Permit application. The scope of work developed for this proposal was based in part on findings of a Phase I hydrogeological investigation conducted by Sweet-Edwards/EMCON, Inc. (SE/E) in November and December, 1987. Soil borings and monitoring well locations were also chosen based on information included in Chemical Processors Solid Waste Management Unit Report, July 5, 1988, to the EPA. Table A-1 summarizes the rationale used in selection of test boring and monitoring well sites. The investigation will include the work elements outlined below:

WORK ELEMENT	DESCRIPTION
1.	Coordinate with Chempro to locate boring locations, check for underground utilities, obtain permission for access on adjacent properties, if necessary, and supervise site preparation for drilling.
2.	Drill eleven shallow borings using a 6-inch I.D. hollow stem auger drilling rig to the base of the shallow water table aquifer (approximately 15 to 30 feet) and collect soil samples using a split spoon or barrel sampler.

added.

TABLE A-1 SUMMARY OF SITE SELECTION CRITERIA

SITE	TYPE	AQUIFER	UNSATURATED/ SATURATED SOIL TESTING	TESTING	RATIONALE FOR SITE LOCATION
TB-1	Test Boring	Shallow	Both	Single time	Area near overhead oil loading rack; downgradient of foamite tanks.
TB-2	Test Boring	Shallow	Both	Single time	Adjacent to oil pit separator; site of former waste water treatment tanks (closed SWMU).
TB-3	Test Boring	Shallow	Both	Single time	Tanker fuel spill (1977) impacted this area.
TB-4	Test Boring	Shallow	Both	Single time	Location of closed SWMU (coolant treatment tank, treated wastewater tank).
TB-5	Test Boring	Shallow	Both	Single time	Adjacent to SWMU.
TB-6	Test Boring	Shallow	Both	Single time	West edge of SWMU (black oil yard).
TB-7	Test Boring	Shallow	Both	Single time	Reported xylene-contaminated soil.
CP-104B	Monitoring well	Deep	No	Quarterly	Provide additional information on deep aquifer system.
CP-107A	Monitoring Well	Shallow	Both	Quarterly	Downgradient of pipe alley and marine oil diesel yard tanker truck loading area.
CP-108A	Monitoring Well	Shallow	Both	Quarterly	Replace existing City of Seattle well.
CP-108B	Monitoring Well	Deep	No	Quarterly	Provide additional information on deep aquifer system.
CP-109A	Monitoring Well	Shallow	Both	Quarterly	Downgradient of marine oil diesel yard (SWMU).
CP-110A	Monitoring Well	Shallow	Both	Quarterly	Downgradient of marine oil diesel yard (SWMU).
SB-1	Soil Boring		Both	NO	Background soil sampling site.
SB-2	Soil Boring		Both	NO	Background soil sampling site.

added

Drill two shallow background soil borings using a 6-inch I.D. hollow stem auger drilling rig to a depth of 10 feet and collect soil samples using a split spoon or barrel sampler.

3. Collect a single time ground water sample from seven shallow T-borings.

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4. Drill two deep borings, using a 6-inch hollow stem auger drilling rig, at least 15 feet into the deep confined aquifer (if present at less than 70 feet).

5. Install and develop single completion monitoring wells in four of the shallow borings and two of the deep borings (if deep aquifer encountered).

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6. Sample ground water from six existing monitoring wells and five new monitoring wells on two separate occasions, approximately one month apart.

added

7. Conduct slug tests in the five new monitoring wells to determine hydraulic conductivities of the saturated deposits.

8. Properly close existing well B-101 (pending owner's approval) after installation of nearby replacement wells

CP-108A and CP-108B.

9. Obtain water levels in the five new monitoring wells and the six existing monitoring wells.

10. Evaluate potential effects of tidal cycles on the shallow water table and deep confined aquifer systems.

11. Prepare report documenting the field investigation and data evaluation, including:

- o Boring logs
- o Summary of completed borings
- o Chain of Custody/Laboratory Request forms
- o Laboratory analyses
- o Slug test results
- o Water levels
- o Extent of subsurface soil contamination

Should Chempro be unable to acquire access to off-site property to accomplish the directives in Paragraph 2, the Company will submit a signed statement as to the efforts made by Chempro to acquire such access and the responses made thereto by the appropriate property owners, and will provide copies of letters or other correspondence made as part of those efforts.

All reasonable efforts will be made to provide and assist employees, agents and contractors of the EPA access to the Pier 91 site in accordance with and pursuant to the authority of 3007

of the Act, 42 U.S.C. 6927. Upon arrival at the site, EPA representatives must proceed directly to the facility office and be able to provide proper identification to the facility manager. After signing a visitor registration log and describing the purpose of the visit, person(s) will be escorted at all times, while on-site, by Chempro personnel. In some cases, site access may be temporarily limited or restricted due to safety concerns resulting from facility operations.

A schedule for the performance of all the work described is attached as Part B. All analytical results from each well sampling event will be submitted to the Agency within thirty days of receipt of the written laboratory report by Chempro. Analytical results shall be accompanied by water level measurement data obtained from all ground water monitoring wells and piezometers.

All reports, plans, proposals and other documents required will be submitted in duplicate to Charles W. Rice, Chief, RCRA Compliance Section, EPA Region 10, 1200 Sixth Avenue, M/S HW-112, Seattle, Washington 98101.

2.0 SITE SAFETY

The field investigation will follow the Site Safety and Quality Assurance Project Plans (Parts C and D, respectively, in this proposal). This plan will be followed with regard to personnel safety during drilling procedures and the handling and sampling of soils and ground water.

3.0 DECONTAMINATION PROCEDURES

The drill rig and all down-hole drilling equipment will be steam cleaned/hot water pressure washed prior to arrival at and departure from the site and between drilling locations. All soil

and ground water sampling equipment will be decontaminated using the following sequence:

- o Non-phosphatic detergent wash
- o Deionized water rinse
- o Dilute acid rinse (pH <2)
- o Deionized water rinse
- o Methanol solution rinse (1:1 solution)
- o Final deionized water rinse

4.0 DRILLING, SOIL AND T-BORING GROUND WATER SAMPLING PROCEDURES

1. Prior to beginning the field program, access agreements for off-site drilling locations will be obtained by Chempro and all drilling locations will be checked for the presence of underground utilities and piping. The drilling will be performed using a hollow stem auger drill rig. Eleven shallow borings will be advanced for soils identification of fill, and visual and chemical identification of contamination. Seven of the shallow borings will be used to collect a single time ground water sample. Up to four deep borings will be drilled in an attempt to encounter the deep confined aquifer beneath the facility in two of the borings.

2. Four of the shallow borings and two deep borings will be completed with monitoring wells. If the deep aquifer is not encountered in any of the four deep borings, no deep monitoring wells will be installed during this investigation. Drill cuttings and well development water will be placed in containers provided and disposed of by Chempro.

3. Each of the eleven shallow T-borings will be advanced to the base of the uppermost saturated zone, a depth of about 15 to 30 feet. The two shallow soil borings will be advanced to a depth of 10 feet. All shallow borings will be continuously sampled to 10 feet and every 5 feet thereafter by driving a 2-inch O.D. split spoon and/or a 3-inch O.D. barrel sampler ahead of the auger bit in 18-inch depth intervals. The locations of the proposed shallow borings are shown in Figure A-1.

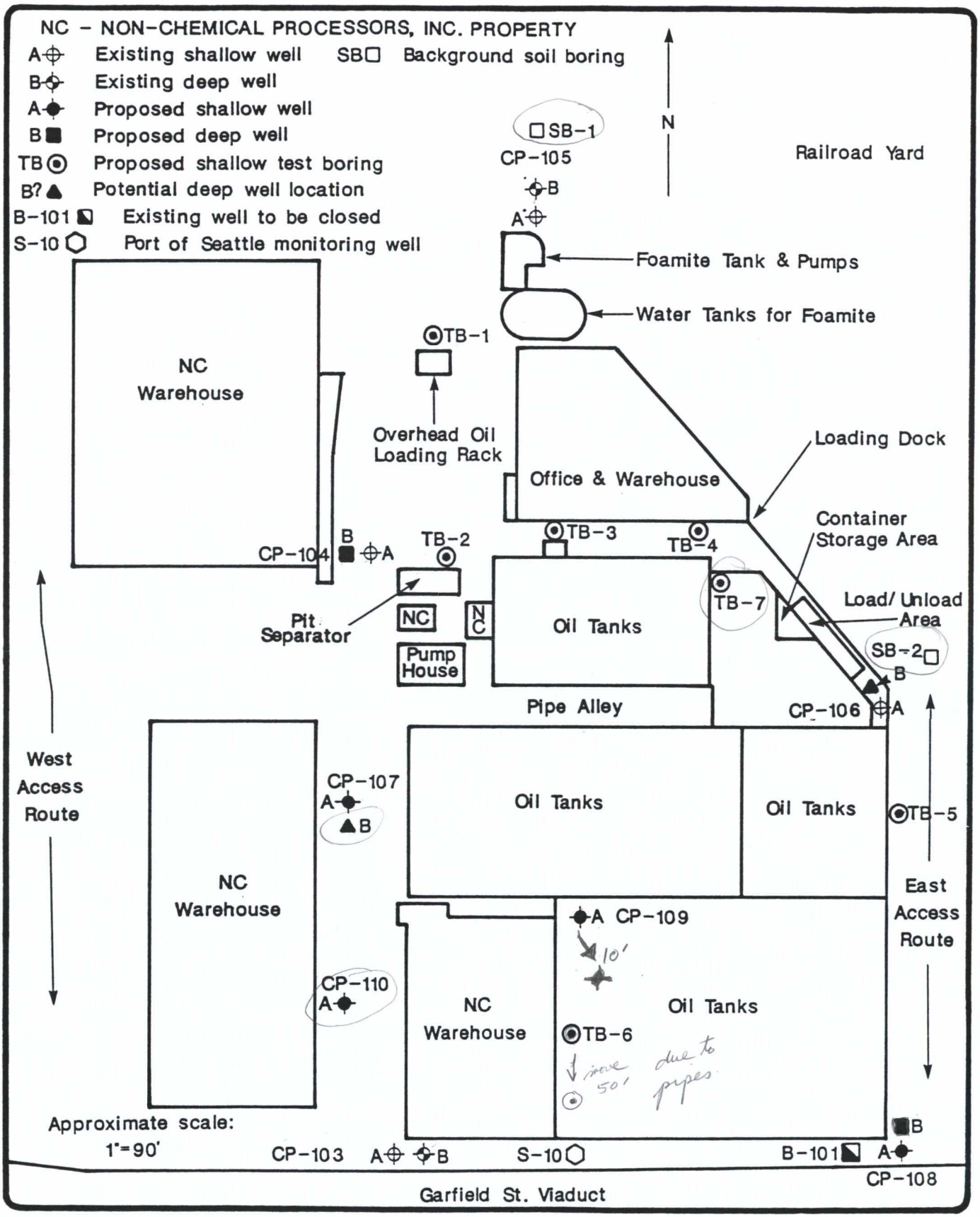
4. The soil samples for each boring will be placed on a clean piece of plastic sheeting, the core split with a knife (if necessary) and photographed. One half of the core split will be placed, using a stainless steel spoon, in sample jars for chemical analysis. The sample will be homogenized by the laboratory prior to sample analysis. The samples collected each day will be delivered or shipped to the testing laboratory that same evening. These samples will be kept cool in an iced cooler until delivery to the lab. The Chain of Custody and Laboratory Analysis Request information will be recorded on form SEA-400-05. The Field Sampling Data form, SEA-44-01, is used to record important data during field sampling. These data include sampling methodologies and equipment. Soil samples will be delivered to the two different analytical laboratories listed below for archiving and/or chemical testing:

   o Columbia Analytical Services, Inc., Longview, WA.

      - Samples to be analyzed for total metals

   o Analytical Resources, Inc., Seattle, WA.

      - Samples to be analyzed for volatile organics (EPA Method 8240) and base/neutral/acids (EPA Method 8270)



Sweet-Edwards EMCON

Figure A-1
PIER 91 FACILITY
SITE PLAN

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One composite sample will be analyzed above the water table (approximately 0 to 5 feet) and one composite sample will be analyzed below the water table (approximately 5 to 10 feet). A grab sample will be collected at an approximate depth of 2.5 feet in each boring. An additional grab sample will be collected at approximately 0.5-foot (if feasible) and 7.5 feet in borings where field observations indicate possible contamination at these depths. Grab samples will be submitted for chemical testing as per the composite samples. All unanalyzed samples and remaining portions of analyzed samples for metals analysis will be archived for future physical evaluation or testing if necessary.

The other half of the core sample will be field logged and described in terms of color, grain size, organic matter, moisture content, density, the presence of oil, and other appropriate characteristics. These descriptions will be recorded on the boring log (SEA form 300-02-01).

5. During drilling of the seven shallow T-borings, ground water samples will be obtained just below the water table with a stainless steel drive point which has been driven past the end of the auger bit into undisturbed sediment. Black iron pipe will be used as the drive casing/riser pipe.

   Before the drive point is installed through the hollow stem auger, at least one standing pore volume of ground water will be pumped. Following installation of the drive point, the drive point screen and casing will be purged until the pH and/or specific conductance of the pumped ground water stabilizes to within ±10%. At stabilization, a ground water sample will be obtained using a double check valve Teflon bailer. Duplicate ground water samples will be obtained from each boring.

Water samples will be delivered to the two analytical laboratories listed below for chemical testing. Sample analysis will include total and dissolved metals, volatile organics, and base/neutral/acids (EPA Methods 8240 and 8270).

- o Columbia Analytical Services, Inc., Longview, WA.
  - Samples to be analyzed for total metals
- o Analytical Resources, Inc., Seattle, WA.
  - Samples to be analyzed for volatile organics and base/neutral/acids (EPA Method 8240 and 8270)

6. The seven T-borings will be closed by simultaneously pulling the 6-inch I.D. hollow stem auger from the borehole while backfilling with bentonite chips to approximately ground surface. Sweet-Edwards/EMCON will notify the Washington Department of Ecology via letter that the soil borings will be closed.

7. Two deep borings will be advanced 15 feet into the deep confined aquifer or a maximum depth of 70 feet. If the deep aquifer is not encountered, a maximum of two additional deep borings will be drilled. All deep borings will be sampled only for visual identification of geologic materials at 5-foot intervals. Sampling methodology will be the same as described for the shallow borings.

8. Any deep borings not encountering the deep confined aquifer will be closed by simultaneously pulling the 6-inch I.D. auger from the borehole while backfilling with bentonite grout.

5.0 MONITORING WELL INSTALLATION

1. Six single completion monitoring wells will be installed. Each well will consist of 10 feet of 2-inch diameter, schedule 40, 0.010-inch machine-slot PVC screen and 2-inch, schedule 40 flush-threaded PVC casing. All shallow wells will be constructed such that the upper 6 inches of well screen are above the high water table, provided there is adequate room (> 2 feet) for a surface seal. Each well will have at least one stainless steel centralizer placed on the screen and/or riser pipe (as necessary). A filter pack consisting of No. 8 x 12 Colorado silica sand will be used as the porous backfill around and 2 feet above each well screen section. A minimum 2-foot plug of bentonite chips, hydrated with water provided by the driller, will be placed above the filter pack. The remainder of the annular space in the deep borings will be backfilled by tremie methods with Volclay bentonite grout. Shallow borings will be backfilled with bentonite chips to within 1 foot of ground surface. The locations of the proposed monitoring wells are shown in Figure A-1.

2. A locking steel casing will be cemented over each well. Surface completions will be about 2-feet above ground surface or at grade as necessary (high traffic areas). Above-grade well completions will consist of a locking steel security casing with two small-diameter (approximately 1/2-inch) vent holes slightly above the sloping concrete surface seal and at least 1 foot below the well cap. Pea gravel will be placed in the annular space between the security casing and the well from about 6 inches below grade to within 6 inches of the well cap. Concrete traffic posts will be installed around the well(s) in high traffic areas. At below-grade completions, efforts will be made to minimize the potential of surface water runoff entering the well

annulus or the well itself. These efforts will include positioning the inner lock cap at or slightly above surface grade, installing a water-tight locking cap, construction of a downward-sloping PVC drain/vent from inside the well security vault to outside saturated drain rock, and sloping the surface concrete seal away from the flush-mounted well security vault. A well construction variance will be applied for in writing by SE/E to the Washington Department of Ecology (WDOE) for all shallow monitoring wells installed.

3. Monitoring Well Installation

   A. The monitoring well installations will be done through a 6-inch I.D. hollow stem auger.

   B. The well casing and screen will be steam cleaned or high pressure hot water washed and the labels and binding tape removed, along with other potentially contaminating materials, prior to installation.

   C. Representative samples of annular sand backfill, rinse water, and other potentially contaminating material will be retained for laboratory analysis.

   D. The well screen and casing assembly, sand backfill, bentonite plug, and grout will be installed as the hollow stem auger is withdrawn from the borehole.

4. Following installation of each monitoring well, the screen zone will be developed by pumping and/or bailing until the discharge water is free of sediment, non-turbid, or shows no further improvement and field measurements of conductivity have stabilized. All new on-site and off-site monitoring wells will be surveyed for vertical elevation (nearest 0.01

foot) and horizontal position (0.01 foot) by a registered surveyor. A recognized datum (City of Seattle) will be the basis for all elevations. All T-borings will be surveyed for horizontal position.

6.0 HYDRAULIC CONDUCTIVITY TESTING

Rising head slug tests will be performed on each new well following development. The tests will utilize a PVC bailer to remove a "slug" of ground water and an electric water level indicator to measure the water level response. Measurements will be analyzed using methods described by Hvorslev (1951) and/or other appropriate techniques.

7.0 MONITORING WELL GROUND WATER SAMPLING

1. The ground water sampling method to be used is designed to obtain samples representative of in situ ground water quality, with minimum contamination due to sampling techniques or materials.

2. Ground water samples will be obtained from the three (3) new well sites CP-107, CP-108, and CP-109 and four existing monitoring well sites (CP-103, CP-104, CP-105, and CP-106).

3. Ground water samples will be delivered to two different analytical laboratories for chemical testing:

    - o Columbia Analytical Services, Inc., Longview, WA.
        - samples to be analyzed for total and dissolved metals
    - o Analytical Resources, Inc., Seattle, WA.
        - Samples to be analyzed for volatile organics and base/neutral/acids (EPA Methods 8240 and 8270)

8.0 WATER LEVEL MEASUREMENTS

Two rounds of depth-to-water measurements will be obtained from the six existing wells and the five new wells. These data will be used to define flow direction in the uppermost saturated zone and the deeper confined aquifer. Depth-to-water measurements will be obtained using an electric water level detector (Olympic Well Probe; Model 300 or equivalent) measured from a surveyed notch at the top of the PVC casing. Measurements will be to the nearest 0.01 foot and will include date, time, and initials of recorder.

The effects of tidal cycles on water level elevations were assessed at Pier 91 in May 1988 by comparing water level fluctuation measurements over a 3-day period and published tidal data. Water level measurements were recorded in deep well CP-105B and shallow well CP-105A. A pressure transducer and a data logger (Hermit Model SE 100B) were utilized to record water level fluctuations. In addition, water levels were recorded for a 6-hour period in wells CP-103A, CP-103B, and CP-104A during the 3-day test.

Results indicate no apparent tidal influence in the shallow water table aquifer (approximately 6 to 25 feet below ground surface). Tidal influences were noted in well CP-103B completed in the deep confined/semi-confined aquifer.

Additional measurement of tidal influence on water level fluctuations will be completed in proposed new wells CP-108B (deep aquifer) and CP-108A (shallow aquifer). Data will be collected for a 24-hour period using a pressure transducer and a data logger (Hermit Model SE 1000B) in selected wells. Water level data will be collected for a 6-hour period concurrent with the 24-hour test, in wells CP-104B, CP-107A, CP-108A, and CP-109A using an electric water level detector.

PART B

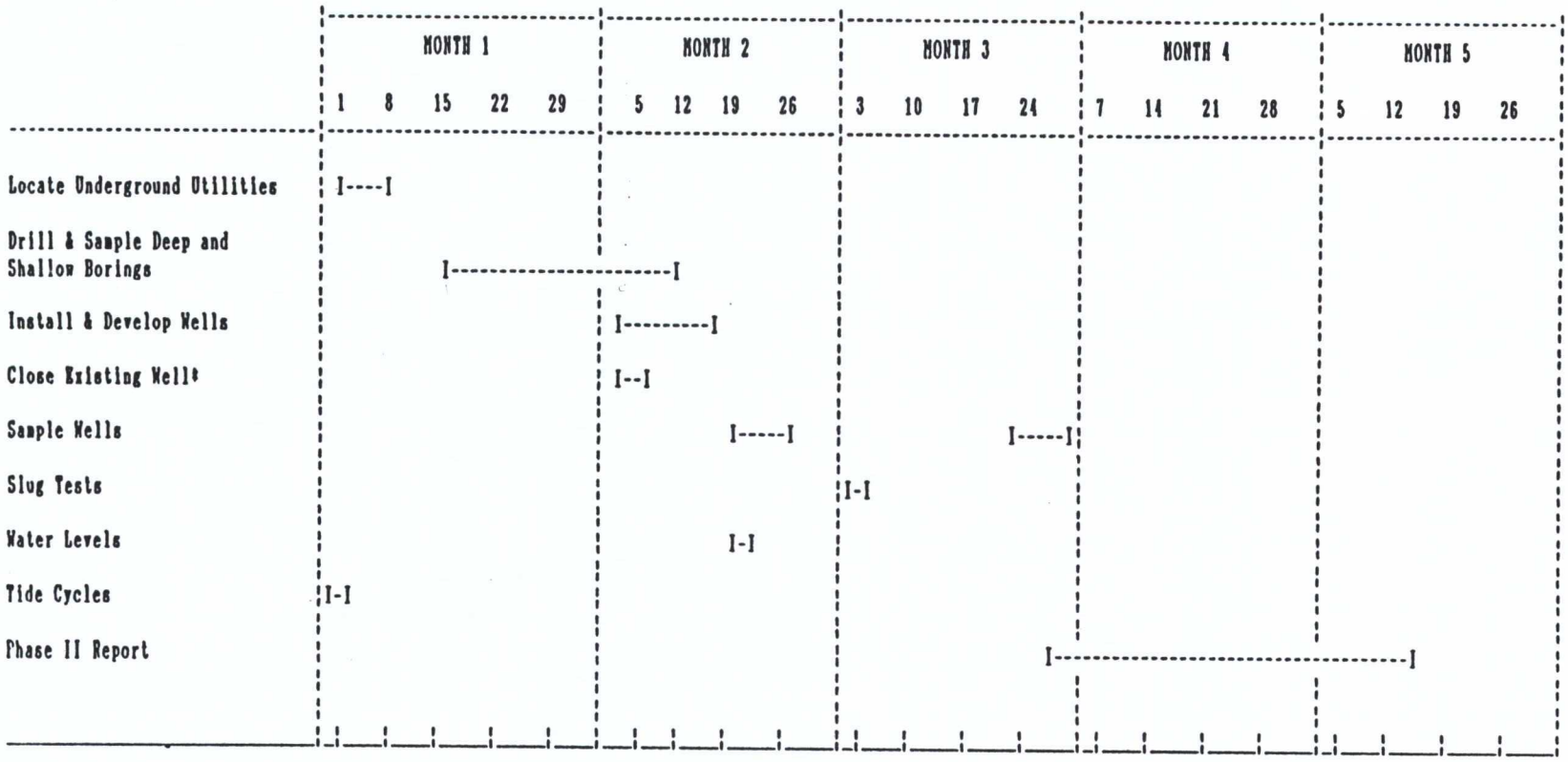
PROJECT SCHEDULE

PART B

PROJECT SCHEDULE

The following schedule of field work and reporting is proposed for the hydrogeologic investigation at the Chemical Processors, Inc. (Chempro) Pier 91 Facility. The proposed schedule is shown on a standard Sunday-to-Saturday, 7-day per week calendar.

PHASE II HYDROGEOLOGICAL INVESTIGATION - CHEMPRO PIER 91 FACILITY



* Pending owner's approval

PART C

HEALTH AND SAFETY PLAN

PHASE II - HYDROGEOLOGIC INVESTIGATIONS
PIER 91

PART C - HEALTH AND SAFETY PLAN

1.0 INTRODUCTION

This Health and Safety Plan has been prepared to address the hazards that the field investigation team may encounter. The plan includes a site description, hazard evaluation, monitoring requirements, work limitations, authorized personnel responsibilities, decontamination requirements, and emergency requirements. The attached Site Safety and Operations Plan, summarizes the contents of the plan.

Sweet-Edwards/EMCON, Inc. (SE/E) has read and understands the OSHA/SARA December 19, 1986, Interim Rule. These standards have been implemented into the safety program developed for the Phase II Hydrogeologic Investigation, Pier 91, at Chemical Processors, Inc.'s (Chempro's) facility in Seattle, Washington. Safety Standards for Construction Work (Chapter 296-155 WAC) and General Occupational Health Standards (Chapter 296-62 WAC) will also be observed.

The Chempro Pier 91 Facility is located close to the shoreline of Elliott Bay in Section 23, Township 25 North, Range 3 East, at 2001 West Garfield Street, Seattle, Washington (Figure C-1). The shoreline has been altered by the placement of some fill for the construction of Pier 91. The site area is generally flat and is covered by concrete pads or asphalt.

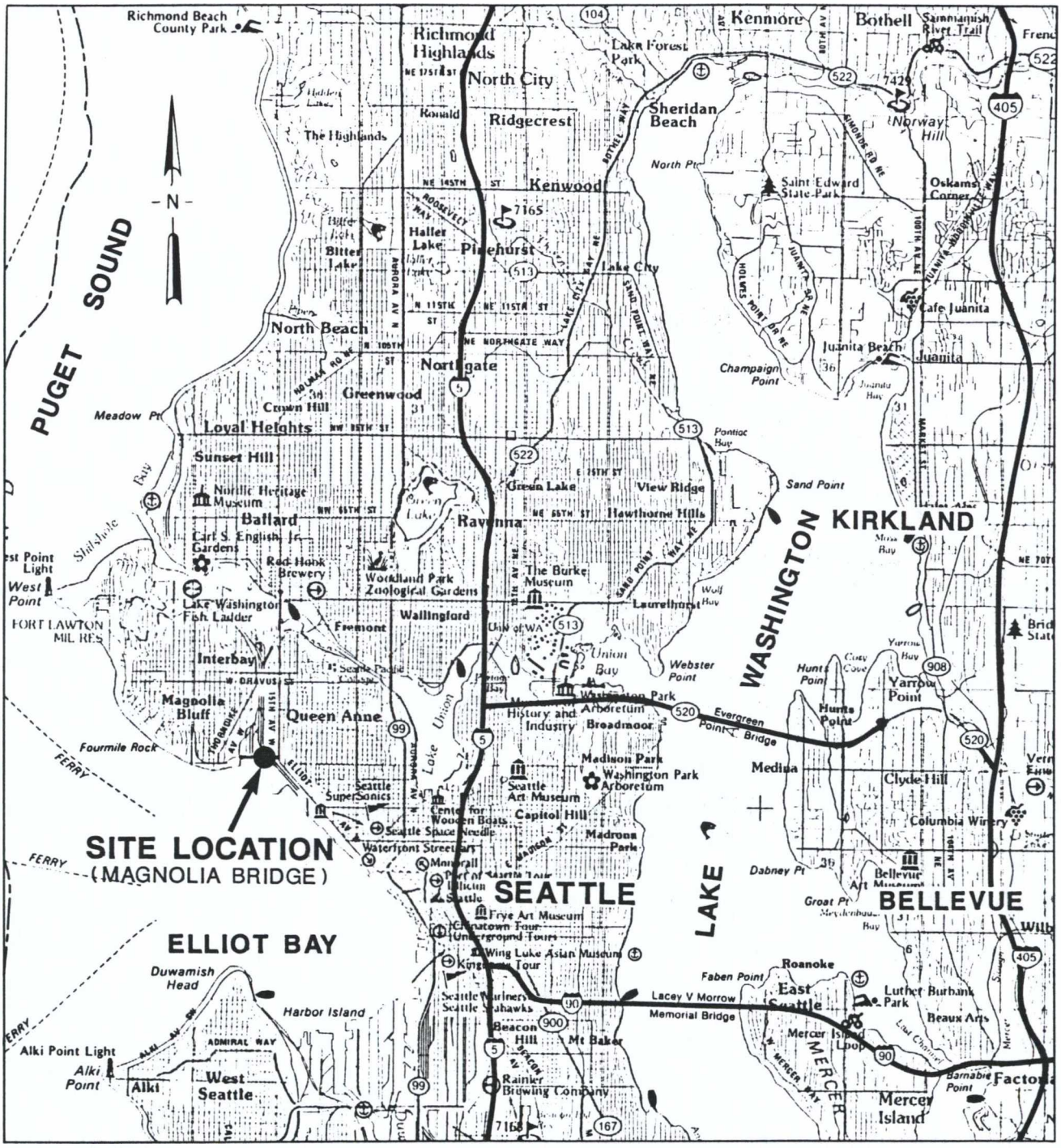


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Figure C-1
CHEMPRO, INC. PIER 91 FACILITY
SITE LOCATION MAP

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2.0 HAZARD EVALUATION

Performing the field activities for the proposed Phase II Hydrogeologic Investigation at the Pier 91 facility poses several health and safety concerns. The hazards to project personnel include chemical exposure, fire, safety hazards, and potential thermal stress. These hazards are a function of the nature of the site as well as a consequence of the work being performed.

The primary potential for chemical exposure comes from drilling, monitoring well installation, and water sampling. Chemical analyses have been performed on ground water samples and detectable levels of some volatile organic compounds have been found in several of the on-site monitoring wells. The volatiles are considered a chemical hazard because of the possibility of inhalation exposure. Semi-volatile compounds and dissolved metals are of concern for splash hazards or direct contact through an open wound. A Material Safety Data Sheet for each of the primary chemicals of concern is attached at the end of Part C.

Physical hazards offer the highest risk to health and safety. The site is active and large trucks are in use. The drill rig creates many physical hazards. Drill rigs and other heavy equipment also create noise hazards.

Thermal exposure may at times be a hazard. Drilling in the warmer months can create heat stress if protective clothing is required. The winter months can create possibilities of cold injury and impaired ability to work.

3.0 MONITORING REQUIREMENTS

The quality of ambient air in the vicinity of all borings will be monitored to ensure that the proper level of protection is used. A Photovac Tip II Photoionization Detector or an Organic Vapor Analyzer (OVA), Sensidyne gas detector tubes, and combustible gas/oxygen detector will be used during the drilling of all wells.

Air quality measurements will be taken frequently when drilling. Sensidyne gas detector tubes will be utilized if appropriate. Air space around the open boreholes will be monitored and the field geologist will determine if additional monitoring is necessary or a higher level of personal safety is needed. The decision for additional monitoring will be based upon field conditions such as change in vapors from the borehole, breakthrough in cartage respirators, complaints of initial acute exposure symptoms from field personnel, or any other indications of a potential hazard.

4.0 LEVEL OF PROTECTION

The selection of personal protection equipment is an integral part of the SE/E Health and Safety Program. The level of protection must be adequate to protect individuals from hazards encountered while working at the Chempro Pier 91 facility. Over-protection can also be hazardous because of heat stress, physical and psychological stress, impaired vision, reduced mobility, and poor communications.

Selection of the level of protection will be based on guidelines summarized in Table C-1. The level of protection will be dependent upon the location and type of activity being conducted.

The selection of respiratory protection will be based on air monitoring in the field. The decision will be made by the SE/E site geologist as to which level is appropriate. Protective clothing (TYVEK coveralls and latex gloves) will be worn at all times. The use of Air Purifying Respirators (APR) will be based on the presence of total organic compounds venting from the borehole, complaints of initial acute exposure symptoms from field personnel, or any other indications of potential hazards. The cartridges used will be Organic Vapor/Acid Gas. The exposure levels for increasing the respirator protection to Level B have been set to account for sufficient worker protection. Once the criteria have been exceeded, an APR will not be a sufficient level of protection and Self-Contained Breathing Apparatus (SCBA) or Positive-Pressure Supplied-Air Respirator (SAR) will be used.

Table C-1

GUIDELINES FOR SELECTING THE LEVEL OF PROTECTION

LEVEL OF PROTECTION	RECOMMENDED:	SHOULD BE USED WHEN:	LIMITING CRITERIA
B	Pressure-demand, full-facepiece SCBA or pressure-demand supplied-air respirator with escape respiratory protection.	The type and atmospheric concentration of substance have been identified and require a high level of respiratory protection SCBA.	Use only when the vapor of gases present are not suspected of containing high concentrations of chemicals that are harmful to skin or capable of being absorbed through the intact skin.
	Chemical-Resistant Clothing	This involves atmospheres: - with IDLH concentrations of specific substances do not represent a severe skin hazard; - OR - - that do not meet the criteria for of air-purifying respirators.	Use only when it is highly unlikely that the work being done will generate either concentrations of vapors, gases, or particulates or splashes of material that will affect exposed skin.
	Inner and Outer Chemical-Resistance Gloves		
	Chemical-Resistant Safety Boots/Shoes	Atmosphere contains less than 19.5 percent oxygen.	
	Hard Hat	Presence of incompletely identified vapors or gases is indicated by direct-reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to the skin or capable of being absorbed through the intact skin.	
	Coveralls, Poly Coat Tyvek		

Table C-1 (cont.)

GUIDELINES FOR SELECTING THE LEVEL OF PROTECTION

LEVEL OF PROTECTION	RECOMMENDED:	SHOULD BE USED WHEN:	LIMITING CRITERIA
C	Full-facepiece, air-purifying, canister-equipped respirator.	The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect any exposed skin.	Atmoshperic concentration of chemicals must not exceed IDLH levels.
	Chemical-Resistant Clothing Inner and Outer Chemical-Resistant Gloves	The types of air contaminants have been identified, concentrations measured, and a canister is available that can remove the contaminant.	The atmosphere must contain at least 19.5 percent oxygen.
	Chemical-Resistant Safety Boots/Shoes	All criteria for the use of air-purifying respirators are met.	
	Hard Hat		
	OPTIONAL: Coveralls, Tyvek Escape Mask		
D	Coveralls Safety Boots/Shoes Safety Glasses or Chemical Splash Goggles Hard Hat	The atmosphere contains no known hazard.	This level should not be worn in the Exclusion Zone.
	OPTIONAL: Gloves, Escape Mask, Face Shield	Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.	The atmosphere must contain at least 19.5 percent oxygen.

FROM: NIOSH/ISHA/USCG/EPA - Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities.

5.0 WORK LIMITATIONS

Heat stress and heat stroke problems can be caused by wearing protective clothing when air temperatures exceed 75° F. The work schedule for personnel wearing clothing and equipment restricting normal air circulation must be regulated. Otherwise, heat stress may become more of a threat than a potential chemical hazard itself.

To reduce the possibilities of heat stress or heat stroke, personnel wearing protective clothing when air temperatures exceed 75° F will have a 10-minute break every hour. At air temperatures less than 75° F, the frequency of rest periods will be decided by the SE/E site geologist.

6.0 AUTHORIZED PERSONNEL RESPONSIBILITIES AND TRAINING

The key project personnel are Dennis Goldman (Project Manager) and Jim Bailey (Project Hydrogeologist). The project manager is responsible for the overall completion of the project. The project geologist is responsible for the completion of the scope of work, following the Health and Safety Plan, supervising additional staff personnel, and conducting the pre-site safety meetings.

The project hydrogeologist will, from time to time, appoint a site geologist. The site geologist will be the site health and safety officer and will be responsible for the health and safety while in the field.

Other personnel on site will be drillers, driller helpers, and support personnel from the selected drilling company.

The field team during drilling will consist of a SE/E site geologist, a driller and driller helpers. The field team will coordinate the work schedule so that one person will be watching the other two. In emergency situations, the free person will be able to assist injured workers.

Site-specific health and safety training will consist of a pre-site safety indoctrination and daily site safety updates. The pre-site safety indoctrination will cover the Health and Safety Plan, as well as any pertinent new information available. Daily site safety updates will inform workers of new hazards or conditions as the need arises.

Field personnel will be trained in accordance with OSHA Training requirements. For most work, Level C and Level D will be required. Should site conditions indicate a need for level B protection, current work will be suspended until level B safety

7.0 EMERGENCY RESPONSE

This is a contingency plan that outlines policies and procedures for responding to site emergency situations. When an emergency occurs, decisive action is required. This plan covers personnel, the site, equipment documentation, and emergency procedures.

The SE/E site geologist will be the site safety officer and will direct emergency response operation. The SE/E site geologist will recommend that work be stopped if any operation threatens workers or the environment.

In an emergency, the SE/E site geologist will identify the emergency and will be responsible for notifying the appropriate emergency response agency. The telephone numbers and addresses for the hospitals, poison control center and emergency transportation (fire, ambulance, police) are listed on page 4 of the Site Safety and Operations Plans (attached).

Safety equipment will be available near the work site. Equipment to be present at the immediate work site will include: fire extinguisher, eye wash station, and personal protection equipment. Equipment to be located approximately 200 feet upwind of the work site will include drinking water, decontamination materials, and a first aid kit. The SE/E site geologist will maintain the safety equipment.

Documentation and reporting of emergency situations will be the responsibility of the SE/E site geologist. In the event of an incident, the project geologist will initiate an investigation. An incident report will be completed by the project hydrogeologist. Copies of the report will be sent to Gerritt Rosenthal (SE/E's Safety Officer), the Project Manager and SE/E's project file. The report will include at minimum a chronological history of the incident, facts as they become available, titles and names of personnel, and history of injuries.

SITE SAFETY AND OPERATIONS PLAN

SITE: Chemical Processors Pier 91 DATE: August 1 1988

LOCATION: 2001 W. Garfield Seattle, Wa. PREPARED BY: J.S. Bailey

CLIENT CONTACT:

PROJECT OBJECTIVE(S): Identify nature and extent of ground water and soil contamination.

SCHEDULED ACTIVITIES/TIME PERIOD: Install, develop and sample ground water of monitoring wells, 5 months from start date.

BACKGROUND REVIEW

	PRELIMINARY	COMPLETE
ACCESS, OVERHEAD/UNDERGROUND UTILITIES, ETC.	X	
WASTE CHARACTERIZATION	X	
HAZARD/SAFETY LEVEL DETERMINATION:	X	

COMMENTS: Extent and configuration of underground piping not known. Products include waste oil products and other petro chemicals.

WASTE TYPE(S) / CHARACTERISTICS

LIQUID	x	SOLID		SLUDGE		GAS	
CORROSIVE	x	IGNITABLE		REACTIVE		VOLATILE	
TOXIC	x	RADIOACTIVE		UNKNOWN		OTHER	

SPECIAL CONSIDERATIONS/COMMENTS: BTEX, VOA's unknowns

S-E/E 100-03a

Sweet-Edwards / EMCON, Inc.

FACILITY DESCRIPTION

SIZE: 1000' x 1400' BUILDINGS/STRUCTURES: Limited

TOPOGRAPHY/ACCESS: Flat. Site gate and sign in every day.

GENERAL GEOLOGIC/HYDROLOGIC SETTING: Fill overlying sands and silts

STORAGE/DISPOSAL METHOD(S): Fuel tank farm

STATUS (active; closed; unknown) : Active

HISTORY (injury; illness; complaints, public or agency) : None known

SPECIAL CONDITIONS/COMMENTS:

HAZARD EVALUATION

Potential risk of drilling into underground buried pipelines.

Sweet, Edwards & Associates, Inc.

OPERATIONS PLAN

MAP/SITE SKETCH ATTACHED AS EXHIBIT A-1 .

SITE CONTROL (for vehicles, workers, public, etc.) SHOWN ON EXHIBIT _____

ZONES OF CONTAMINATION: ☐ Known ☐ Projected ☒ Unknown

EXCAVATION, DRILLING OR SAMPLING METHOD: Hollow stem auger drilling method with split spoon sampling.

COMMENTS: _____

SAFETY EQUIPMENT AND PROCEDURES

LEVEL OF PROTECTION: ☐ A ☐ B ☒ C ☐ D

ADDITIONS/MODIFICATIONS: Organic cartridges to be made available.

SPECIAL SURVEILLANCE EQUIPMENT AND MATERIALS: Photovac II-photoionization detector.

DECONTAMINATION PROCEDURES: Standard wash for personnel. All equipment to be soap washed, steam cleaned, DI rinsed, HCl rinsed, methanol rinsed, and final DI rinse. Disposable clothing to be disposed of in a drum at the site.

P.D.S. STATION(S): Eye wash station at SEA vehicle.

P.D.S. EQUIPMENT, MATERIALS AND SPECIAL FACILITIES: Eye wash station, skin rinse and wash; inhalation exposure will be treated by removal from immediate area.

S-E/E 100-03c

SITE ENTRY PROCEDURES

SITE TEAM (No.): 2-4 Sweet-Edwards ____Client ____Agency 0 Other

ENTRY BRIEFING DATE: 1/24/87 LOCATION: At site

SITE WORK TEAM (name/responsibility) 1. D. Stefani, Chempro

2. Mel Miller, Chempro 3. A. E. Little, Personnel

4. Jim Bailey, SE/E 5. Dennis Goldman(SEA) Project manager

6. Steve Nelson, SE/E 7. Driller and helper

SPECIAL CONDITIONS (e.g., work schedule or limitations):

EMERGENCY PROCEDURES

ACUTE EXPOSURE SYMPTOM(S):	FIRST AID
1. Skin irritation from acids	Gloves, wash with water, rinse
2. caustics and metals	
3.	
4. Respirators to be kept available	Fresh air, rest
5. at all times	
6.	

HOSPITALS/EMERGENCY MED. CENTER (Address/phone#) MAP ATTACHED: ☐ Y ☐ N

1. Swedish Hospital, 747 Summit-386-2573
2. Saint Cabrini Hospital of Seattle, Terry & Madison-682-0500
3. Virginia Mason, 925 Seneca- 624-1144
4.

EMERGENCY TRANSPORTATION (fire, ambulance, police):

1. Dial 911 for assistance
2.
3.
4.

S-E/E 100-03d

Sweet-Edwards / EMCON, Inc.

EMERGENCY ROUTES:

1. Swedish, Cabrini and Virginia Mason are all in the same vicinity
2. Take Elliott Avenue W. traveling south to Denney Way, left on Denney Way to
3. I-5 South to exit Seneca Street to Madison Street
4. _____

SAFETY/HEALTH EQUIPMENT CHECKOUT LIST

GENERAL SAFETY:

First Aid Kit	[x]	Eye Wash Station	[ ]
Safety Glasses/Face Shield	[x]	Drinking Water	[ ]
Safety Shoes/Gloves	[x]	Tyvek Suits/Vinyl Gloves	[ ]
Personal Clothing Change	[x]	Field Test Meters	[ ]
Wash/Decontamination Materials	[x]	_____	[ ]

SPECIFIC SAFETY EQUIPMENT:

- [x] Respirator: Type (dust, cartridge, SCBA, etc.) _____
- [ ] Combustible Gas/Explosimeter
- [ ] Oxygen Indicator
- [ ] Dosimeter Badge(s)
- [ ] HNU/OVA Survey
- [x] Photovac tip
- [ ] _____

SPECIAL CONDITIONS/COMMENTS: Polycoat Tyvek or comparible vinyl inner glove and Solvex outer glove.

Note: All Sweet-Edwards personnel are to understand and comply with specific practices and guidelines as described in the QA/QC Manual regarding field safety and health hazards.

SIGN-OFF:

SIGNED _____ DATE _____

SIGNED _____ DATE _____

SIGNED _____ DATE _____

SIGNED _____ DATE _____

PUT REVISIONS ON REVERSE AS NEEDED

S-E/E 100-03e

Sweet-Edwards / EMCON, Inc.

MATERIAL SAFETY DATA SHEETS

Material Safety Data Sheet

W : Acetone, Recycled

QUICK IDENTIFIER
Common Name: (used on label and list)

May be used to comply with OSHA's Hazard Communication Standard, 29CFR 1910. 1200. Standard must be consulted for specific requirements.

H 3
F 3
R 1
PERSONAL PROTECTION J

SECTION 1 -

Manufacturer's Name - Chemical Processors, Inc.

Address: 5501 Airport Way South

Emergency Telephone No. (206). 767-0350

City, State, and ZIP: Seattle, WA 98108

Other Information Calls: Same

Signature of Person Responsible for Preparation (Optional)

Date Prepared: 2 November 1985

SECTION 2 – HAZARDOUS INGREDIENTS/IDENTITY

Hazardous Component(s) (chemical & common name(s))	OSHA PEL ppm	ACGIH TLV ppm	Other Exposure Limits IDLH*–ppm	% (optional)	CAS NO.
Acetone	1,000	1,000	20,000	60–80%	67.64.1
Toluol	200	200		0–10.0	
Methyl Ethyl Ketone	200	200		0–10.0	
Alcohols	1,000	1,000		0–10.0	
Xylene	100	100		0–9.0	
Non-Chlorinated Solvents	1,000	1,000		0–1.0	
Chlorinated Solvents	200	200		0.1	

* Immediately dangerous to life and health

SECTION 3 - PHYSICAL & CHEMICAL CHARACTERISTICS

Boiling Point: 133°F

Specific Gravity (H₂O=1): 0.81

Vapor Pressure (mm Hg): 180mm

Vapor Density (Air = 1): 2.0

Solubility in Water: Miscible

Reactivity in Water: Not applicable

Appearance and Odor: colorless, mint-like odor pungent, sweet taste

Melting Point: -94.6°C -138°F

SECTION 4 – FIRE & EXPLOSION DATA

Flash Point: 1.4. F.-17. Method Used: closed cup

Flammable Limits in Air % by Volume: LEL Lower 2.6% UEL Upper 12.8

Auto-Ignition Temperature: 869°F

Extinguisher Media: dry chemical, water spray carbon dioxide or alcohol

Special Fire Fighting Procedures: Sealed containers may rupture when exposed to excessive temperatures

Unusual Fire and Explosion Hazards: Vapor - air mixtures are explosive above flash point

SECTION 5 – PHYSICAL HAZAR[illegible] (REACTIVITY DATA)

Stability: Unstable ☐ Stable ☒ Conditions to Avoid: avoid high temperatures and exposure to open flames.

Incompatability (Materials to Avoid): acids, oxidizers, amines, chloride-salts, and hydrogen peroxide

Hazardous Decomposition Products: may emit irritating and poisonous carbon monoxide under thermal decomposition

Hazardous Polymerization: May Occur ☐ Will Not Occur ☒ Conditions to Avoid

SECTION 6 – HEALTH HAZARDS

1. Acute: fatigue, eyes, ears, throat irritant 2. Chronic: may cause breathlessness and pulmonary edema

Signs and Symptoms of Exposure: cough, shortness of breath, dizziness and nasal irritation.

Medical Conditions Generally Aggravated by Exposure: pre-existing respiratory problems and skin disorders

Chemical Listed as Carcinogen or Potential Carcinogen: no — National Toxicology Program: Yes ☐ No ☒ — I.A.R.C. Monographs: Yes ☐ No ☒ — OSHA: Yes ☐ No ☒

Emergency and First Aid Procedures: Pre-existing respiratory problems and skin disorders.

ROUTES OF ENTRY

1. Inhalation: Mildly toxic. 20,000 ppm immediately dangerous to life
2. Eyes: Irritant.
3. Skin: Irritant, acute-redness and mucous membrane irritation.
4. Ingestion: Neurotoxic/anesthetic.

SECTION 7 – SPECIAL PRECAUTIONS AND SPILL/LEAK PROCEDURES

Precautions to be Taken in Handling and Storage: Store away from heat, sparks or flame. Containers may explode in heat or fire.

Other Precautions: Vapor explosion hazard indoors, outdoors and in sewers. Run-off to the sewer may create fire or explosion hazard.

Steps to be Taken in Case Material is Released or Spilled: Cut off ignition sources. Stop leak if possible. Use water spray to reduce vapors. Use absorbent for small spills.

Waste Disposal Methods (Consult federal, state, and local regulations): Should be disposed of in a permitted treatment, storage or disposal facility.

SECTION 8 – SPECIAL PROTECTION INFORMATION/CONTROL MEASURES

Respiratory Protection (Specify Type): 5,000 ppm – Gas mask with an organic vapor cartridge 20,000 ppm-SCBAe escape-SCBA

Ventilation	Local Exhaust	Mechanical (General)	Special	Other
	X	N.A.	N.A.	N.A.

Protective Gloves: Butyl — Eye Protection: Face sheild

Other Protective Clothing or Equipment: Wear impervious clothing.

Work/Hygienic Practices: No Smoking.

IMPORTANT

Do not leave any blank spaces. If required information is unavailable, unknown, or does not apply, so indicate.

MATERIAL SAFETY DATA SHEET

J.T.Baker CHEMICALS

J. T. Baker Chemical Co., 222 Red School Lane, Phillipsburg, N.J. 08865

SECTION I. IDENTIFICATION OF PRODUCT

CHEMICAL NAME	FORMULA
Benzene	C_6H_6
SYNONYM OR CROSS REFERENCE	CAS NO: 71-43-2

SECTION II. HAZARDOUS INGREDIENTS

MATERIAL	NATURE OF HAZARD

SECTION III. PHYSICAL DATA

BOILING POINT	MELTING POINT
80.0° - 80.2°C.	5.51°C.
VAPOR PRESSURE	SPECIFIC GRAVITY
100 mm @ 26.1°C.	0.88
VAPOR DENSITY (AIR=1)	PERCENT VOLATILE BY VOLUME (%)
2.77	
WATER SOLUBILITY	EVAPORATION RATE
Slightly	(_____ = 1)

APPEARANCE
Colorless liquid with aromatic odor

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (method used)	FLAMMABLE LIMITS	Lower	Upper
12°F. (cc)		1.3%	7.1%

FIRE EXTINGUISHING MEDIA: Alcohol foam, dry chemical or carbon dioxide

SPECIAL FIRE-FIGHTING PROCEDURES

UNUSUAL FIRE AND EXPLOSION HAZARD

SECTION V. HEALTH HAZARD

THRESHOLD LIMIT VALUE
10 ppm orl-mus LD_{50}: 4700 mg/kg

HEALTH HAZARDS
POISON! Harmful if inhaled

FIRST AID PROCEDURES If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, do not induce vomiting. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Call a physician.

SECTION VI . REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	-

INCOMPATABILITY (materials to avoid)

Aluminum Chloride, Permanganate, Sulfuric Acid, Potassium Peroxide, Silver Perchlora Sodium Peroxide, Chlorine, Nitryl Perchlorate, Oxygen, Ozone, Perchloryl Fluoride

HAZARDOUS DECOMPOSITION PRODUCTS

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

SECTION VII . SPILL AND DISPOSAL PROCEDURES

SPILLS Eliminate all sources of ignition. Absorb on sand, earth or vermiculite. Carefully sweep up and remove. Flush spill area with water. Alternatively use J.T. Baker's Flammable Solvent Spill Clean-up Kit (product No. 4437) or Solusorb® Solvent Absorbent (Product No. 4458)

DISPOSAL
Atomize into a furnace with after-burner and scrubber, if local environmental regulations permit.

SECTION VIII . PROTECTION INFORMATION

RESPIRATORY PROTECTION (specify type)
Self-contained breathing apparatus

VENTILATION	LOCAL X	SPECIAL
	MECHANICAL (general) X	OTHER

PROTECTIVE GLOVES Rubber gloves	EYE PROTECTION Face shield

OTHER PROTECTIVE EQUIPMENT
Approved working clothes

SECTION IX . HANDLING AND STORAGE PRECAUTIONS

STORAGE & HANDLING
Keep away from heat, sparks, flame. Keep container out of sun and away from heat. Keep in tightly closed container. Separate from oxidizing material.

SECTION X . MISCELLANEOUS INFORMATION

Avoid breathing vapor. Avoid contact with eyes, skin, clothing. Use with adequate ventilation. Clinical and epidermiological data establish benzene as leukemogenic in man and is considered to be a carcinogen. EXERCISE DUE CARE.

Date issued: _____ Approved by R. M. Mitchell
Manager, Quality Assurance

Revision No. & Date Issued: _____

MATERIAL SAFETY DATA SHEET

J. T. Baker Chemical Co., 222 Red School Lane, Phillipsburg, N.J. 08865

SECTION I. IDENTIFICATION OF PRODUCT

CHEMICAL NAME	FORMULA
Toluene	$C_6H_5CH_3$
SYNONYM OR CROSS REFERENCE Toluol Methacide Methylbenzene Phenylmethane	CAS NO: 108-88-3

SECTION II. HAZARDOUS INGREDIENTS

MATERIAL		NATURE OF HAZARD

SECTION III. PHYSICAL DATA

BOILING POINT	MELTING POINT
111°C.	-95°C.
VAPOR PRESSURE 36.7 mmHg at 30°C.	SPECIFIC GRAVITY 0.87
VAPOR DENSITY (AIR=1) 3.14	PERCENT VOLATILE BY VOLUME (%)
WATER SOLUBILITY Insoluble	EVAPORATION RATE (_____= 1)

APPEARANCE
Colorless, refractive liquid with benzene-like odor.

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (method used)	FLAMMABLE LIMITS	Lower	Upper
40°F. (closed cup)			

FIRE EXTINGUISHING
MEDIA Water spray, carbon dioxide, dry chemical, foam.

SPECIAL FIRE-FIGHTING PROCEDURES

UNUSUAL FIRE AND EXPLOSION HAZARD
Flammable liquid

SECTION V. HEALTH HAZARD

THRESHOLD LIMIT VALUE
200 ppm ipr-rat LD_{50}: 1640 mg/kg orl-rat LD_{50}: 7.53 ml/kg

HEALTH HAZARDS
Harmful if inhaled or swallowed. Causes eye irritation.

FIRST AID PROCEDURES If inhaled, remove to fresh air. Administer artificial respiration or oxygen as necessary. Call a physician. If swallowed, do not induce vomiting; if conscious, cautiously give warm water, then mineral oil followed by hot coffee or tea. Call a physician. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician. Flush skin with water.

SECTION VI . REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID Heat, sparks, and flame
	STABLE	X	

INCOMPATABILITY (materials to avoid)

HAZARDOUS DECOMPOSITION PRODUCTS

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

SECTION VII . SPILL AND DISPOSAL PROCEDURES

SPILLS

Eliminate all sources of ignition and flammables. Absorb spill on sand, earth or vermiculite. Carefully sweep up and remove. Allow to evaporate. Flush spill area with water. Alternatively use J. T. Baker Flammable Liquid Spill Kit.

DISPOSAL

Atomize into an incinerator providing environmental regulations permit. Combustion may be improved by mixing with a more flammable solvent.

SECTION VIII . PROTECTION INFORMATION

RESPIRATORY PROTECTION (specify type)

All-purpose canister mask available.

VENTILATION	LOCAL Preferable	SPECIAL
	MECHANICAL (general)	OTHER

PROTECTIVE GLOVES Rubber gloves	EYE PROTECTION Safety glasses; face shield

OTHER PROTECTIVE EQUIPMENT

Approved working clothes; eyebath

SECTION IX . HANDLING AND STORAGE PRECAUTIONS

STORAGE & HANDLING

Protect containers against physical damage.
Keep away from heat, sparks, and flame.
Keep in tightly closed container. Wash thoroughly after handling.

SECTION X . MISCELLANEOUS INFORMATION

Avoid contact with eyes, skin, or clothing.
Avoid breathing vapor.
Use with adequate ventilation.
Avoid prolonged or repeated contact with skin.

Date issued: 3/84 Revision: _____ Approved by R. M. Mitchell

Manager, Quality Assurance

aldrich chemical co.
P.O. Box 355, Milwaukee, Wisconsin 53201 USA • (414) 273-3850

ATTN: SAFETY DIRECTOR
CHEMICAL PROCESSORS
5501 AIRPORT WAY SOUTH
SEATTLE WA 98108
HECTOR SANCHEZ

CUST # 153656 DATE: 08/10/87 P.O. # 11494

MATERIAL SAFETY DATA SHEET

IDENTIFICATION

PRODUCT # 29632-5 NAME: M-XYLENE, ANHYDROUS, 99+%
CAS # 108-38-3

TOXICITY HAZARDS

RTECS # ZE2275000
M-XYLENE
IRRITATION DATA
SKN-RBT 10 UG/24H OPEN SEV AIHAAP 23,95,62
TOXICITY DATA
ORL-RAT LD50:5 GM/KG YAKUDS 22,883,80
IPR-MUS LD50:1739 MG/KG ARTODN 58,106,85
SKN-RBT LD50:14100 MG/KG AIHAAP 23,95,62
REVIEWS, STANDARDS, AND REGULATIONS
ACGIH TLV-TWA 100 PPM; STEL 150 PPM 85INA8 5,637,86
MSHA STANDARD-AIR:TWA 100 PPM (440 MG/M3) (SKIN) OTLVS* 3,281,71
OSHA STANDARD-AIR:TWA 100 PPM FEREAC 39,23540,74
NIOSH REL TO XYLENE-AIR:TWA 100 PPM;CL 200 PPM/10M MMWR** 34(1S),31S,85
EPA TSCA CHEMICAL INVENTORY, 1986
EPA TSCA 8(A) PRELIMINARY ASSESSMENT INFORMATION, FINAL RULE FEREAC 47,26992,82
EPA TSCA SECTION 8(E) STATUS REPORT 8EHQ-1080-0368
EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, DECEMBER 1986
MEETS CRITERIA FOR PROPOSED OSHA MEDICAL RECORDS RULE FEREAC 47,30420,82

ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR COMPLETE INFORMATI

HEALTH HAZARD DATA

ACUTE EFFECTS
MAY BE HARMFUL BY INHALATION, INGESTION, OR SKIN ABSORPTION.
VAPOR OR MIST IS IRRITATING TO THE EYES, MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT.
EXPOSURE CAN CAUSE:
NARCOTIC EFFECT.
LUNG IRRITATION, CHEST PAIN AND EDEMA WHICH MAY BE FATAL.
CNS DEPRESSION
DERMATITIS
GASTROINTESTINAL DISTURBANCES
CHRONIC EFFECTS
DAMAGE TO THE KIDNEYS
BLOOD EFFECTS
DAMAGE TO THE LIVER
FIRST AID
IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
CALL A PHYSICIAN.
WASH CONTAMINATED CLOTHING BEFORE REUSE.

chemists helping chemists in research & industry

aldrich chemical co.

P.O. Box 355, Milwaukee, Wisconsin 53201 USA • (414) 273-3850

MATERIAL SAFETY DATA SHEET

CATALOG # 29632-5 NAME: M-XYLENE, ANHYDROUS, 99+%

PHYSICAL DATA

BOILING POINT: 138 C TO 139 C
SPECIFIC GRAVITY: 0.868

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: 77 F
EXTINGUISHING MEDIA
CARBON DIOXIDE, DRY CHEMICAL POWDER, ALCOHOL OR POLYMER FOAM.
WATER MAY BE EFFECTIVE FOR COOLING, BUT MAY NOT EFFECT EXTINGUISHMENT.
SPECIAL FIRE FIGHTING PROCEDURES
WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO PREVENT CONTACT WITH SKIN AND EYES.
FLAMMABLE.
USE WATER SPRAY TO COOL FIRE-EXPOSED CONTAINERS.
UNUSUAL FIRE AND EXPLOSION HAZARDS
VAPOR MAY TRAVEL CONSIDERABLE DISTANCE TO SOURCE OF IGNITION AND FLASH BACK.
CONTAINER EXPLOSION MAY OCCUR UNDER FIRE CONDITIONS.
FORMS EXPLOSIVE MIXTURES IN AIR.

REACTIVITY DATA

INCOMPATIBILITIES
OXIDIZING AGENTS
HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS
TOXIC FUMES OF:
CARBON MONOXIDE, CARBON DIOXIDE

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
EVACUATE AREA.
SHUT OFF ALL SOURCES OF IGNITION.
WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY RUBBER GLOVES.
COVER WITH AN ACTIVATED CARBON ADSORBENT, TAKE UP AND PLACE IN CLOSED CONTAINERS. TRANSPORT OUTDOORS.
VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.
WASTE DISPOSAL METHOD
BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER BUT EXERT EXTRA CARE IN IGNITING AS THIS MATERIAL IS HIGHLY FLAMMABLE.

OBSERVE ALL FEDERAL, STATE & LOCAL LAWS.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

WEAR APPROPRIATE NIOSH/MSHA-APPROVED RESPIRATOR, CHEMICAL-RESISTANT GLOVES, SAFETY GOGGLES, OTHER PROTECTIVE CLOTHING.
MECHANICAL EXHAUST REQUIRED.
SAFETY SHOWER AND EYE BATH.
USE NONSPARKING TOOLS.
DO NOT BREATHE VAPOR.
AVOID CONTACT WITH EYES, SKIN AND CLOTHING.
WASH THOROUGHLY AFTER HANDLING.
IRRITANT.
KEEP TIGHTLY CLOSED.
KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAME.
STORE IN A COOL DRY PLACE.

ADDITIONAL PRECAUTIONS AND COMMENTS

NOT APPLICABLE

USA
Aldrich Chemical Co., Inc.
940 West Saint Paul Avenue
Milwaukee, Wisconsin 53233
Telephone: (414) 273-3850
TWX: (910) 262-3052 Aldrichem Mil
Telex: 26 843 Aldrich Mil
FAX: (414) 273-4979

Belgium
Aldrich Chemie N.V./S.A.
6 Rue Cesarei Claes
B-1000 Brussels
Telephone: (02) 2428750
Telex: 62302 Aldrich B

France
Aldrich-Chimie S.a.r.l.
27, Fosse des Treize
F-67000 Strasbourg
Telephone: (88) 327010
Telex: 890376 Aldrich F
FAX: (88) 75 12 83

Japan
Aldrich Japan
Kyoei Bldg. Shinsenda
10 Kandasurugadai
Chiyoda-ku, Tokyo
Telephone: (03) 256-0155
FAX: (03) 256-0157

United Kingdom
Aldrich Chemical Co., Ltd.
The Old Brickyard, New Road
Gillingham, Dorset SP8 4JL
Telephone: (07478) 2211
Telex: 417238 Aldrich G
FAX: (07478) 3779

West Germany
Aldrich-Chemie GmbH & Co. KG
D-7924 Steinheim
Telephone: (07329) 87-0
Telex: 714838 Aldri D
FAX: (07329) 87-38

chemists helping chemists in research & industry

aldrich chemical co.

P.O. Box 355, Milwaukee, Wisconsin 53201 USA • (414) 273-3850

ATTN: SAFETY DIRECTOR
CHEMICAL PROCESSORS
5501 AIRPORT WAY SOUTH
SEATTLE WA 98108
HECTOR SANCHEZ

DATE: 08/10/87
CUST # 153656 P.O. # 11494

MATERIAL SAFETY DATA SHEET

IDENTIFICATION

PRODUCT # 29478-0 NAME: O-XYLENE, ANHYDROUS, 97%
CAS # 95-47-6

TOXICITY HAZARDS

RTECS # ZE2450000
O-XYLENE
TOXICITY DATA
IHL-HMN LCLO:6125 PPM/12H YAKUD5 22,883,80
IPR-MUS LD50:1364 MG/KG ARTODN 58,106,85
REVIEWS, STANDARDS, AND REGULATIONS
ACGIH TLV-TWA 100 PPM; STEL 150 PPM 85INA8 5,637,86
MSHA STANDARD-AIR:TWA 100 PPM (440 MG/M3) (SKIN) DTLVS* 3,281,71
OSHA STANDARD-AIR:TWA 100 PPM FEREAC 39,23540,74
NIOSH REL TO XYLENE-AIR:TWA 100 PPM;CL 200 PPM/10M MMWR** 34(1S),31S, 85
EPA TSCA CHEMICAL INVENTORY, 1986
EPA TSCA 8(A) PRELIMINARY ASSESSMENT INFORMATION, FINAL RULE FEREAC 47,26992,82
EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, DECEMBER 1986
MEETS CRITERIA FOR PROPOSED OSHA MEDICAL RECORDS RULE FEREAC 47,30420, 82

ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR COMPLETE INFORMATIC

HEALTH HAZARD DATA

ACUTE EFFECTS
MAY BE HARMFUL BY INHALATION, INGESTION, OR SKIN ABSORPTION.
VAPOR OR MIST IS IRRITATING TO THE EYES, MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT.
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LUNG IRRITATION, CHEST PAIN AND EDEMA WHICH MAY BE FATAL.
CNS DEPRESSION
DERMATITIS
GASTROINTESTINAL DISTURBANCES
CHRONIC EFFECTS
DAMAGE TO THE LIVER
DAMAGE TO THE KIDNEYS
BLOOD EFFECTS
FIRST AID
IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
CALL A PHYSICIAN.
WASH CONTAMINATED CLOTHING BEFORE REUSE.

PHYSICAL DATA

BOILING POINT: 143 C TO 145 C
SPECIFIC GRAVITY: 0.869

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FAX: (88) 75 12 83

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FORM 020 REV. 2-86

chemists helping chemists in research & industry

aldrich chemical co.

P.O. Box 355, Milwaukee, Wisconsin 53201 USA • (414) 273-3850

MATERIAL SAFETY DATA SHEET

CATALOG # 29478-0 NAME: O-XYLENE, ANHYDROUS, 97%

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: 90 F

EXTINGUISHING MEDIA
CARBON DIOXIDE, DRY CHEMICAL POWDER, ALCOHOL OR POLYMER FOAM.
WATER MAY BE EFFECTIVE FOR COOLING, BUT MAY NOT EFFECT EXTINGUISHMENT.

SPECIAL FIRE FIGHTING PROCEDURES
WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO PREVENT CONTACT WITH SKIN AND EYES.
FLAMMABLE.
USE WATER SPRAY TO COOL FIRE-EXPOSED CONTAINERS.

UNUSUAL FIRE AND EXPLOSION HAZARDS
VAPOR MAY TRAVEL CONSIDERABLE DISTANCE TO SOURCE OF IGNITION AND FLASH BACK.
CONTAINER EXPLOSION MAY OCCUR UNDER FIRE CONDITIONS.
FORMS EXPLOSIVE MIXTURES IN AIR.

REACTIVITY DATA

INCOMPATIBILITIES
OXIDIZING AGENTS

HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS
TOXIC FUMES OF:
CARBON MONOXIDE, CARBON DIOXIDE

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
EVACUATE AREA.
SHUT OFF ALL SOURCES OF IGNITION.
WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY RUBBER GLOVES.
COVER WITH AN ACTIVATED CARBON ADSORBENT, TAKE UP AND PLACE IN CLOSED CONTAINERS. TRANSPORT OUTDOORS.
VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.

WASTE DISPOSAL METHOD
BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER BUT EXERT EXTRA CARE IN IGNITING AS THIS MATERIAL IS HIGHLY FLAMMABLE.

OBSERVE ALL FEDERAL, STATE & LOCAL LAWS.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

WEAR APPROPRIATE NIOSH/MSHA-APPROVED RESPIRATOR, CHEMICAL-RESISTANT GLOVES, SAFETY GOGGLES, OTHER PROTECTIVE CLOTHING.
MECHANICAL EXHAUST REQUIRED.
SAFETY SHOWER AND EYE BATH.
USE NONSPARKING TOOLS.
DO NOT BREATHE VAPOR.
AVOID CONTACT WITH EYES, SKIN AND CLOTHING.
WASH THOROUGHLY AFTER HANDLING.
IRRITANT.
KEEP TIGHTLY CLOSED.
KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAME.
STORE IN A COOL DRY PLACE.

ADDITIONAL PRECAUTIONS AND COMMENTS

NOT APPLICABLE

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aldrich chemical co.

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ATTN: SAFETY DIRECTOR
CHEMICAL PROCESSORS
5501 AIRPORT WAY SOUTH
SEATTLE WA 98108
HECTOR SANCHEZ

DATE: 08/10/87
CUST # 153656 P.O. # 11494

MATERIAL SAFETY DATA SHEET

IDENTIFICATION

PRODUCT # 29633-3 NAME: P-XYLENE, ANHYDROUS, 99+%
CAS # 106-42-3

TOXICITY HAZARDS

RTECS # ZE2625000
P-XYLENE
TOXICITY DATA
ORL-RAT LD50:5 GM/KG YAKUDS 22,883,80
IHL-RAT LC50:4550 PPM/4H 36YFAG -,302,77
IPR-RAT LD50:3810 MG/KG 36YFAG -,302,77
IPR-MUS LD50:2110 MG/KG ARTODN 58,106,85
REVIEWS, STANDARDS, AND REGULATIONS
ACGIH TLV-TWA 100 PPM; STEL 150 PPM 85INA8 5,637,86
MSHA STANDARD-AIR:TWA 100 PPM (440 MG/M3) (SKIN) DTLVS# 3,281,71
OSHA STANDARD-AIR:TWA 100 PPM FEREAC 39,23540,74
NIOSH REL TO XYLENE-AIR:TWA 100 PPM;CL 200 PPM/10M MMWR## 34(1S),31S, 85
EPA TSCA CHEMICAL INVENTORY, 1986
EPA TSCA 8(A) PRELIMINARY ASSESSMENT INFORMATION, FINAL RULE FEREAC 47,26992,82
EPA TSCA SECTION 8(E) STATUS REPORT BEHQ-1080-0368
EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, DECEMBER 1986
MEETS CRITERIA FOR PROPOSED OSHA MEDICAL RECORDS RULE FEREAC 47,30420, 82

ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR COMPLETE INFORMATIO

HEALTH HAZARD DATA

ACUTE EFFECTS
MAY BE HARMFUL BY INHALATION, INGESTION, OR SKIN ABSORPTION.
VAPOR OR MIST IS IRRITATING TO THE EYES, MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT.
NARCOTIC EFFECT.
LUNG IRRITATION, CHEST PAIN AND EDEMA WHICH MAY BE FATAL.
CNS DEPRESSION
DERMATITIS
GASTROINTESTINAL DISTURBANCES
CHRONIC EFFECTS
DAMAGE TO THE LIVER
DAMAGE TO THE KIDNEYS
BLOOD EFFECTS
FIRST AID
IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
CALL A PHYSICIAN.
WASH CONTAMINATED CLOTHING BEFORE REUSE.

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aldrich chemical co.
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MATERIAL SAFETY DATA SHEET

CATALOG # 29633-3 NAME: P-XYLENE, ANHYDROUS, 99+%

PHYSICAL DATA

BOILING POINT: 138 C
SPECIFIC GRAVITY: 0.866
VAPOR DENSITY: 3.7

FIRE AND EXPLOSION HAZARD DATA

LOWER EXPLOSION LEVEL: 1.1%
UPPER EXPLOSION LEVEL: 7.0%
FLASH POINT: 81 F

EXTINGUISHING MEDIA
CARBON DIOXIDE, DRY CHEMICAL POWDER, ALCOHOL OR POLYMER FOAM.
WATER MAY BE EFFECTIVE FOR COOLING, BUT MAY NOT EFFECT EXTINGUISHMENT.

SPECIAL FIRE FIGHTING PROCEDURES
WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO PREVENT CONTACT WITH SKIN AND EYES.
FLAMMABLE.
USE WATER SPRAY TO COOL FIRE-EXPOSED CONTAINERS.

UNUSUAL FIRE AND EXPLOSION HAZARDS
VAPOR MAY TRAVEL CONSIDERABLE DISTANCE TO SOURCE OF IGNITION AND FLASH BACK.
CONTAINER EXPLOSION MAY OCCUR UNDER FIRE CONDITIONS.
FORMS EXPLOSIVE MIXTURES IN AIR.

REACTIVITY DATA

INCOMPATIBILITIES
OXIDIZING AGENTS

HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS
TOXIC FUMES OF:
CARBON MONOXIDE, CARBON DIOXIDE

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
EVACUATE AREA.
SHUT OFF ALL SOURCES OF IGNITION.
WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY RUBBER GLOVES.
COVER WITH AN ACTIVATED CARBON ADSORBENT, TAKE UP AND PLACE IN CLOSED CONTAINERS. TRANSPORT OUTDOORS.
VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.

WASTE DISPOSAL METHOD
BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER BUT EXERT EXTRA CARE IN IGNITING AS THIS MATERIAL IS HIGHLY FLAMMABLE.

OBSERVE ALL FEDERAL, STATE & LOCAL LAWS.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

WEAR APPROPRIATE NIOSH/MSHA-APPROVED RESPIRATOR, CHEMICAL-RESISTANT GLOVES, SAFETY GOGGLES, OTHER PROTECTIVE CLOTHING.
MECHANICAL EXHAUST REQUIRED.
SAFETY SHOWER AND EYE BATH.
USE NONSPARKING TOOLS.
DO NOT BREATHE VAPOR.
AVOID CONTACT WITH EYES, SKIN AND CLOTHING.
WASH THOROUGHLY AFTER HANDLING.
IRRITANT.
KEEP TIGHTLY CLOSED.
KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAME.
STORE IN A COOL DRY PLACE.

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FORM 020 REV. 2-86

PART D

QUALITY ASSURANCE PROJECT PLAN

PART D - QUALITY ASSURANCE PROJECT PLAN

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) is based on Sweet-Edwards/EMCON's (SE/E) standard QA/QC program and includes the principal elements detailed in the Washington Department of Ecology (WDOE) December 1986 Quality Assurance Interim Guidelines.

This document includes Quality Assurance (QA) procedures for soil sampling, well construction, ground water sample collection, obtaining water level measurements, data analysis and validation, and reporting to the United States Environmental Protection Agency. The goals of this document are:

- To ensure that high-quality, verifiable data are collected
- To encourage cost-effective use of resources
- To ensure that data are usable by Chempro, the State of Washington Department of Ecology, and the United States Environmental Protection Agency (EPA).

2.0 PROJECT DESCRIPTION

The purpose of the Phase II - Hydrogeologic Investigation at Pier 91 is to define the nature and extent of contamination in soils and ground water beneath the Chempro facility at Seattle, Washington. The goal of the study is to complete the hydrogeologic site investigation at Pier 91 initiated in the Phase I Hydrogeologic Investigation, Pier 91 Facility (Sweet-Edwards/EMCON, May 1988). A second goal of the study is to develop the data and monitoring system needed for a RCRA Part B Permit application.

3.0 PROJECT ORGANIZATION

This section outlines the project organization and responsibilities for the Phase II Hydrogeologic Investigation at Pier 91. The figure on the following page schematically shows the project organization. Dennis Goldman (Project Manager) and Jim Bailey (Project Hydrogeologist) will be the two key individuals and responsible for the cost-effective completion of this Phase II investigation.

Chemical Processors Inc, and SE/E will review together the project status and interim findings on a regular basis throughout the duration of the investigation. Internally, all staff working on the project will be responsible for communicating with the Project Hydrogeologist and the Project Manager.

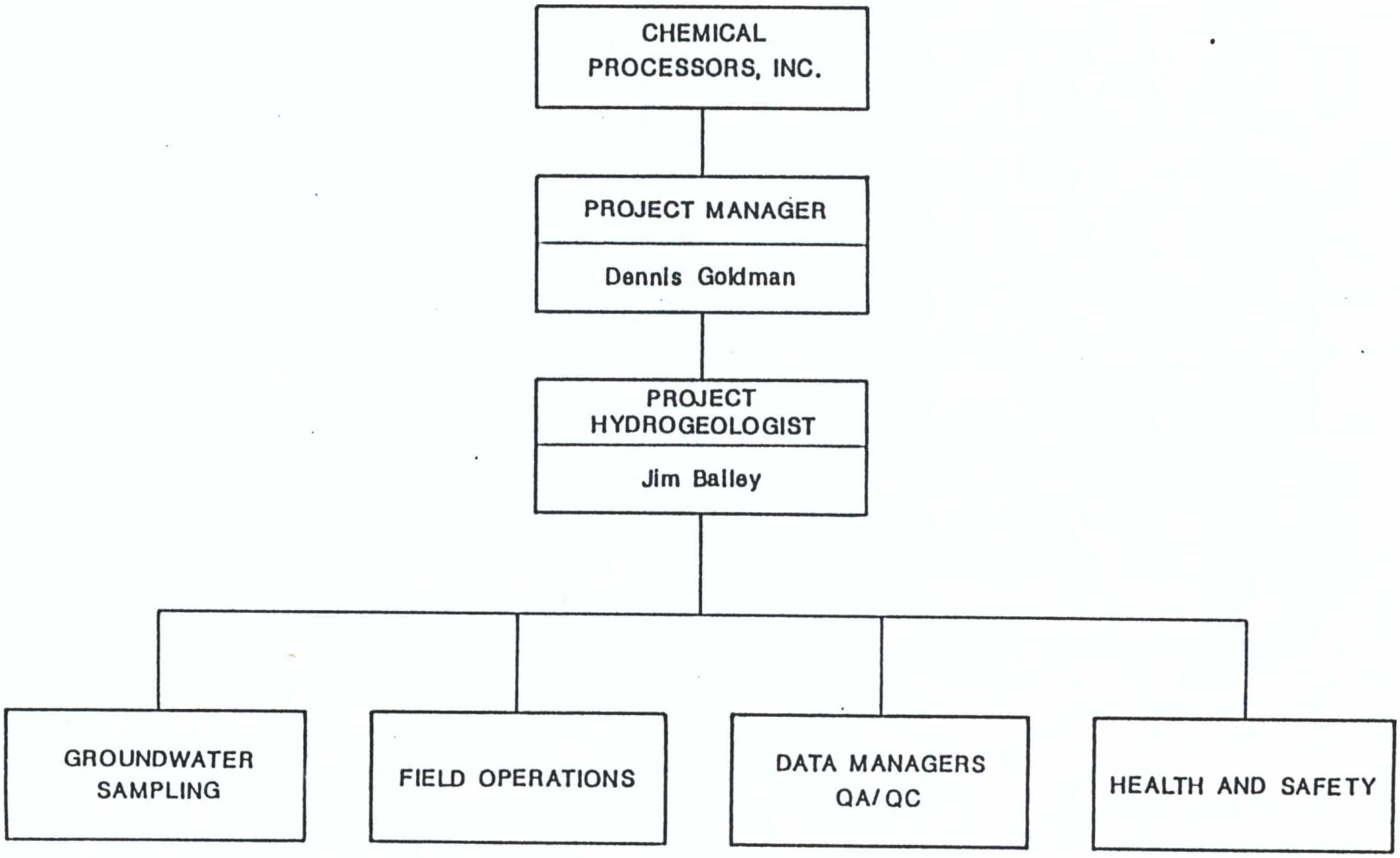
Management and control procedures are in effect at SE/E that ensure the completion of work efforts, the timely delivery of work results, and the economical use of budgets in producing these results. The system involves the following steps:

- Comprehensive definition of work tasks
- Detailed calendar scheduling of work tasks
- Identification of task leaders
- Detailed review of budget expenditures and comparison of planned to actual progress realized
- Procedures for timely correction of any problem discovered through the above steps

Resumes of the key individuals to be involved with the Phase II Hydrogeologic Investigation at Pier 91 are presented in Appendix A.

PROJECT ORGANIZATION/MANAGEMENT

CHEMICAL PROCESSORS, INC.
PHASE II HYDROGEOLOGIC INVESTIGATION



4.0 SCOPE OF WORK

The investigation will be completed according to the work tasks outlined below:

TASK 1 - LOCATE BORINGS AND UNDERGROUND PIPING

TASK 2 - DRILLING, SOIL AND T-BORING GROUND WATER SAMPLING

TASK 3 - MONITORING WELL INSTALLATION

TASK 4 - GROUND WATER SAMPLING

TASK 5 - HYDRAULIC CONDUCTIVITY TESTING

TASK 6 - WATER LEVEL MEASUREMENTS

TASK 7 - TIDAL STUDY

TASK 8 - EXISTING WELL CLOSURE

TASK 9 - REPORT PREPARATION

4.1 TASK 1 - LOCATE BORINGS AND UNDERGROUND UTILITIES

Prior to beginning the field program, access for each drilling location will be obtained by Chempro. All proposed drilling locations will be checked for the presence of underground, and the proximity of aboveground, utilities and piping. Chempro will supply as-built underground facility piping plans for Pier 91. SE/E will obtain a site-wide utilities search.

4.2 TASK 2 - DRILLING, SOIL AND T-BORING GROUND WATER SAMPLING

4.2.1 Drilling and Borehole Logging

Drilling for soil and ground water sampling and/or the installation of ground water monitoring wells will be performed at the Chempro Pier 91 facility using a hollow-stem auger drilling rig equipped with a 6-inch I.D. hollow-stem auger. All

drilling activities will be performed under the direct supervision of a driller licensed in the State of Washington. SE/E will supervise all drilling activities.

A log of subsurface soils will be prepared for each boring location (refer to Appendix C). Each boring log will include the following information:

- Name and location of project
- Boring number and well number
- Drilling contractor, drilling method, and sampling method
- Detailed description of soils encountered
- Well construction details

All drill cuttings and discharge water will be placed in containers and disposed of by Chempro.

4.2.2 Shallow Boring Soil Sampling

Each shallow test boring will be advanced to a depth of approximately 15 to 30 feet. Each background soil boring will be drilled to a depth of 10 feet. All shallow borings will be continuously sampled for 10 feet and every 5 feet thereafter by driving a 2-inch O.D. split spoon and/or a 3-inch O.D. barrel sampler ahead of the auger bit in 18-inch depth intervals.

The soil samples for each boring will be placed on a clean piece of plastic sheeting, and the core split with a knife (if necessary) and photographed. One half of the split core will be placed in sample jars for chemical analysis. The samples collected each day will be delivered or shipped to the testing laboratory that evening. These samples will be kept cool in an iced cooler until delivery to the lab. The Chain of Custody and Laboratory Analysis Request information will be recorded on form

SE/E-400-05 (Appendix D). The Field Sampling Data form, SE/E-44-01 (Appendix D), is used to record important data during field sampling. These data include sampling methodologies and equipment. Soil samples will be delivered to the two different analytical laboratories listed below for archiving and/or chemical testing:

- o Columbia Analytical Services, Inc., Longview, WA
  - Samples to be analyzed for total metals
- o Analytical Resources, Inc., Seattle, WA
  - Samples to be analyzed for volatile organics (EPA Method 8240) and base/neutral/acids (EPA Method 8270)

Table D-1 shows the proposed analytes under investigation and proposed testing methods.

In each shallow boring, one composite sample will be analyzed from above the water table between depths of approximately 1 and 5 feet. One composite sample will be analyzed from below the water table (approximately 5 to 10 feet) in each boring. All unanalyzed samples and remaining portions of analyzed samples for metals analysis will be archived for future physical evaluation or testing, if necessary.

The other half of the core sample will be field logged and described in terms of color, grain size, organic matter, moisture content, density, the presence of oil, and other appropriate characteristics. These descriptions will be recorded on the boring log (SE/E form 300-02-01).

4.2.3 T-Boring Ground Water Sampling

In seven shallow T-borings, ground water samples will be obtained just below the water table with a stainless steel drive point

Table D-1

SAMPLING PARAMETERS AND LABORATORY METHODOLOGY

EPA Method 8240:

Chloromethane
Bromomethane
Vinyl Chloride
Chloroethane
Methylene Chloride
Trichlorofluoromethane
1,1-Dichloroethene
1,1-Dichloroethane
trans-1,2-Dichloroethene
Chloroform
1,2-Dichloroethane
1,1,1-Trichloroethane
Carbon Tetrachloride
Bromodichloromethane
1,2-Dichloropropane
trans-1,3-Dichloropropene
Trichloroethene
Benzene
Dibromochloromethane
1,1,2-Trichloroethane
cis-1,3,-Dichloropropene
2-Chloroethylvinyl ether
Bromoform
1,1,2,2-Tetrachloroethane
Tetrachloroethene
Toluene
Chlorobenzene
Ethyl Benzene
1,3-Dichlorobenzene
1,2-Dichlorobenzene
1,4-Dichlorobenzene
Chrysene
Dibenzo(a,h)anthracene
Fluoranthene
Fluorene
Indeno(1,2,3-cd)pyrene
Naphthalene
Phenanthrene
Pyrene

EPA Method 8270:

Acenaphthene
Acenaphthylene
Aldrin
Abthracene
Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(ghi)perylene
Benzo(a)pyrene
Benzidine
Butyl benzyl phthalate
__-BHC
__-BHC
Bis (2-chloroethoxy) metrane
Bis (2-chloroethyl) ether
Bis (2-chloroisopropyl) ether
Bis (2-ethylhexyl) phthalate
4-Bromophenyl phenyl either
2-Chloronaphthalene
4-Chlorophenyl phenyl ether
Chrysene
4,4'-DDD
4,4'-DDE
4,4'-DDT
Dibenzo(a,h)anthracene
Di-n-butyl phthalate
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
3,3-Dichlorobenzidine
Diethylphthalate
Dimethyl phthalate

EPA Method 200.7:

Beryllium
Cadmium
Chromium
Copper
Nickel
Zinc

EPA Method 206.2:

Arsenic

EPA Method 239.2:

Lead

which has been driven past the end of the auger bit into undisturbed sediment. Black iron pipe will be used as the drive casing/riser pipe.

Before the drive point is installed through the hollow stem auger, at least one standing pore volume of ground water will be pumped from inside of the hollow auger. Following installation of the drive point, the drive point screen and casing will be purged until the pH and/or specific conductance of the pumped ground water stabilizes to within ±10%. At stabilization, a ground water sample will be obtained using a double check valve Teflon bailer. Duplicate ground water samples will be obtained from each boring.

Water samples will be delivered to the two analytical laboratories listed below for chemical analysis. Sample analysis will include total and dissolved metals, volatile organics, and base/neutral/acids (EPA Methods 8240 and 8270).

- o Columbia Analytical Services, Inc., Longview, WA.
  - Samples to be analyzed for total metals

- o Analytical Resources, Inc., Seattle, WA.
  - Samples to be analyzed for volatile organics and base/neutral/acids (EPA Method 8240 and 8270)

4.2.4 Deep Boring Drilling and Sampling

The deep borings will be advanced to a maximum depth of 70 feet unless the deep confined aquifer is encountered at or above this depth. If the deep aquifer is not encountered, the boring will be permanently closed. If the aquifer is intercepted, the boring will penetrate 15 feet into it. Between two and four borings will be drilled depending on if and where on-site the deep confined aquifer is encountered. All deep borings will be

sampled only for visual identification of geologic materials at 5-foot intervals. Sampling methodology will be the same as described for the shallow borings.

4.2.5 Boring Decommissioning

The seven T-borings will be closed by simultaneously pulling the 6-inch I.D. hollow stem auger from the borehole while backfilling with bentonite chips to approximately ground surface. Any deep borings not encountering the deep confined aquifer will be closed as per the shallow borings with the exception of a bentonite grout in place of bentonite chips. SE/E will notify the Washington Department of Ecology via letter that the soil borings will be closed.

4.2.6 Decontamination Procedures

All drilling equipment will be steam cleaned prior to drilling the first boring at the site. Drilling equipment will also be steam cleaned between drilling of each boring to lower the risk of cross-contamination from boring to boring.

All soil sampling equipment, i.e., split-spoon samplers, catchers, drill rods and collection materials, will be thoroughly decontaminated prior to sample collection at each boring. The decontamination procedure will be as follows:

- Steam clean or high pressure wash
- Hexane rinse (optional to remove persistent contaminants)
- Distilled water rinse
- Dilute HCl acid rinse (pH <2)
- Distilled water rinse
- Methanol rinse (1:1 solution)

- Distilled water rinse
- Final distilled water rinse

All cleaning solutions, wash water, and rinse water will be directed toward and into an on-site collection system.

4.3 TASK 3 - MONITORING WELL INSTALLATION

4.3.1 Well Installation

A single completion monitoring well will be installed in five of the borings. Each monitoring well will consist of schedule 40, 2-inch O.D. flush-threaded PVC screen, bottom sump, and riser pipe. All screens will be factory slotted 0.01-inch diameter and 10 feet in length. Each well will have at least one (as necessary) stainless steel centralizer placed on the screen. A filter pack consisting of 8 x 12 Colorado Silica Sand will be placed around and extend approximately 2 feet above and below the screened interval. A minimum 2-foot plug of bentonite chips, hydrated with water provided by the driller, will be placed above the filter pack. The remainder of the annular space in the deep borings will be backfilled by tremie methods with Volclay bentonite grout. Shallow borings will be backfilled with bentonite chips to within 1 foot of ground surface. All well construction material will be installed in the borehole as the hollow stem auger is removed. Sufficient annular construction materials (e.g., filter pack or grout) will remain inside the auger during installation to prevent formation material from heaving up inside the auger. A ground water well construction variance in accordance with WAC 173-160 will be requested for each shallow monitoring well, if required.

All well construction materials will be steam cleaned or high pressure hot water washed and any labels and binding tape

removed prior to installation. Representative samples of annular sand backfill, rinse water and other potentially contaminated material will be retained for laboratory analysis.

4.3.2 Well Development

Following installation of each monitoring well, the well's screen zone will be developed by pumping, bailing, and/or surging until the discharge water is free of sediment, non-turbid, or shows no further improvement, and field measurements of pH, temperature, and conductivity have stabilized.

A Master Flex high capacity peristaltic pump will be used in conjunction with a 5-foot-long PVC bailer, fitted with a Brady 1-inch diameter foot valve, to develop each well screen interval. All discharge water will be directed into a container at the well site and disposed of by Chempro.

4.3.3 Surveying

All new monitoring wells and T-boring sites will be surveyed by a registered surveyor. New and existing monitoring wells will be surveyed for vertical elevation and horizontal position. All T-borings will be surveyed for horizontal position. The vertical survey on the new monitoring wells at the Chempro Pier 91 facility will utilize the City of Seattle datum, as per information provided by the City Survey Department. Each well will be surveyed in accordance with the following guidelines:

> All wells (new and existing) used for the measurement of ground water surface elevations shall be surveyed for vertical elevation. The basis for all elevations shall be a recognized USGS datum. The top of the well casing shall be surveyed to the nearest 0.01 foot. A mark shall be placed on the well casing indicating the location which was surveyed. Vertical surveys shall be of third-order accuracy.

4.4 TASK 4 - GROUND WATER SAMPLING

4.4.1 Sample Container Preparation and Preservatives

All sample containers will be prepared and provided by the selected analytical laboratory. Samples will be preserved as per recommendations given in Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1979. Table D-2 summarizes the proposed analytical parameters, EPA recommended containers, sample preservation, handling, and holding times. The type and size of container used for each parameter and any preservative will be recorded on a field sampling data sheet.

4.4.2 Field Instrument Calibration and Maintenance

Time-sensitive parameters, i.e., temperature, pH, and specific conductance, will be measured in the field at the time of sample collection. Measurements will be recorded to the following standards: pH to ± 0.01 units; conductivity to ± 1 microhm; temperature to ± 0.5°C. Field instruments will be calibrated using known, standard solutions a minimum of twice daily. Calibration, procedures, date, and time will be recorded in instrument log books. Measurements will be obtained using a DSPH-3 pH/conductivity meter or equivalent. Backup instruments will be available in the event of a malfunction. Instrument maintenance will be performed as necessary by the manufacturer. Temperature will be measured with a centigrade scale thermometer.

4.4.3 Sampling Procedure

Well Purging

A minimum of three well casing volumes will be removed before collection of any sample for laboratory analysis. Well casing volumes will be removed with a Master Flex high-capacity

Table D-2

GROUND WATER SAMPLE PARAMETERS, CONTAINERS, PRESERVATIVES AND HOLDING TIMES

MATRIX	PARAMETER	CONTAINER	PRESERVATIVE	HOLDING TIME
	ORGANICS			
Ground Water	Volatile Organics	40-ml glass bottle; Teflon septum in lid	cool to 4°C, fill with fill with no headspace	14 days
	Base Neutrals and Acids	Glass, Teflon-lined cap	cool to 4°C, 0.008% $NA_2S_2O_3$	7 days until extraction 40 days after extraction
	Organochloride pesticides and PCBs	Glass, Teflon-lined cap	cool to 4°C, pH 5-9	40 days after extraction
	INORGANIC TESTS			
Ground Water	pH	Polyethylene or glass	cool to 4°C	Analyze immediately
	Specific Conductance	Polyethylene or glass	cool to 4°C	24 hours
	Temperature		NA	Analyze immediately
	METALS			
Ground Water	Totals and Dissolved	Polyethylene or glass	HNO_3 to pH <2	6 months
	Mercury	Polyethylene or glass	HNO_3 to pH <2	28 days

peristaltic pump. Conductivity, temperature, and pH will be taken after the removal of each well casing volume. Samples will not be collected until these parameters have stabilized to ± 10 percent. Well purging data will be recorded on the Field Sampling Data sheets (see Appendix D).

Sample Collection

Samples for volatile organics will be collected with a double check valve Teflon bailer. A bottom drain sampling device will be used to collect samples from the Teflon bailer. The sample will be poured down the sides of the organic sample bottle and not splashed into its base. Samples collected for volatile organics will have no head space to minimize the possibility of volatilization of the organics.

Ground water samples collected for laboratory analyses of organic parameters or total metals will not be field or laboratory filtered. Samples collected for dissolved metals will be filtered at the time of sample collection.

QED Sample Pro or similar 0.45-micron, in-line filters will be used to field filter samples. Two models may be used: a standard model, which filters up to 1 liter in normal sampling operations, and a high-capacity model designed for larger samples or more turbid water conditions. The disposable filters will attach directly to the peristaltic pump discharge tube. Each in-line filter shall only be used once.

Sample Containers

Samples will be transferred in the field from the sampling equipment to a container specifically prepared for given parameters. Samples will not be composited in a common container in the field and then split in the lab. The type of container

used for each parameter, the size, and the preservative used will be recorded on the Field Sampling Data sheet. Ground water samples will then be delivered to two different analytical laboratories for chemical testing:

- o Columbia Analytical Services, Inc., Longview, WA.
  - Samples to be analyzed for total and dissolved metals
- o Analytical Resources, Inc., Seattle, WA
  - Samples to be analyzed for volatile organics and base/neutral/acids (EPA Methods 8240 and 8270)

4.4.4 Quality Control Samples

Quality control samples consisting of field blanks, transport blanks, duplicate samples and sample splits will be obtained. All blanks and duplicates will be labeled in code such that they are submitted "blind" to the analytical laboratory.

Duplicate ground water samples and sample splits will be obtained by alternately filling like sample bottles for two sample sets until all containers are full. All T-boring ground water samples will be collected as duplicates. Approximately ten percent of all ground water samples from monitoring wells will be collected as duplicates.

Field blanks (method blanks) will be obtained following equipment decontamination by collecting distilled water that has passed through the sampling equipment. Field blanks will be tested at a rate of about 10 percent of total samples.

Transport blanks will be provided by the analytical laboratory, will accompany the shipment of sample bottles to the site, and will return to the laboratory for analysis with the sample

shipment. The transport blanks will be filled with de-ionized water at the laboratory and will not be opened until returned to the laboratory for analysis. One transport blank per sampling day will be incorporated.

4.4.5 Sample Labeling, Shipping, Chain-of-Custody and Field Sample Data

Sample Labeling

Sample container labels will be completed immediately prior to sample collection. Container labels will include the following information:

- Sample number
- Name of collector
- Date and time of collection
- Place of collection

Sample Shipping

Ground water samples will be shipped to an analytical laboratory with the following procedure:

- Sample containers will be transported at 4°C in a sealed ice chest or other suitable container.
- Glass bottles will be separated in the shipping container by absorbent material to prevent breakage.
- Ice will be placed in separate plastic bags and sealed.
- All sample shipments will be accompanied by a Chain-of-Custody Laboratory Analysis Request Form. The completed

Chain-of-Custody Forms will be enclosed in a plastic bag and taped to the inside lid of the cooler.

- Signed and dated chain-of-custody seals will be placed on all coolers prior to shipping.

- The consultant's office, name, and address will be placed in the shipping container.

Chain-of-Custody

Upon transfer of sample possession to subsequent custodians, a Chain-of-Custody Form will be signed by the persons transferring custody of the sample container. Upon receipt of samples at the laboratory, the shipping container seal will be broken and the condition of the samples will be recorded by the receiver. Chain-of-custody records will be included in the analytical report prepared by the laboratory.

Field Sample Data

SE/E's Field Sampling Data forms will be used during ground water sampling for this study. These sheets provide documentation of the following information:

- Project name
- Sample number
- Location and sampling source
- Time and date of sampling
- Pertinent well data, e.g., depth to water
- Sampling method, e.g., dedicated pump
- Preservation
- Volume, type, and number of containers

- Weather
- Field-measured parameters of pH, temperature, and specific conductance
- Sample storage
- Comments, e.g., appearance of sample

4.4.6 Site Documentation

Accurate documentation of field activities will be maintained using field log books, field data forms, correspondence records and photographic slides. Entries will be made in sufficient detail to provide an accurate record of field activities without reliance on memory.

Field log entries will be dated and include a chronologic description of task activities, names of individuals present, names of visitors, weather conditions, etc. All entries will be legibly entered in ink and will be signed.

When photographs are taken, the project number, date, picture number and a description of the photograph will be entered on a photography log form (see Appendix E).

4.5 TASK 5 - HYDRAULIC CONDUCTIVITY TESTING

Rising or falling head "slug" tests will be performed in each new monitoring well. Tests will be performed a minimum of two days after development has been completed in each well. Each test will be initiated by either the instantaneous removal of a "slug" of ground water or the instantaneous displacement of ground water by a weighted "dart". For a rising head slug test, only one, 1-inch-diameter PVC bailer volume of water will be removed from each well. Depth-to-water measurements (rate-of-rise) will be taken using either an Olympic electric water level probe or a

Hermit Environmental Datalogger Model SE-1000B with 10-psi transducer. Measurements will be analyzed using both numerical and graphical methods developed by Hvorslev and other appropriate techniques.

4.6 TASK 6 - WATER LEVEL MEASUREMENTS

Depth-to-water measurements will be obtained with an Olympic Well probe or similar instrument. Water levels will be measured to the nearest 0.01 foot. Well probes will be calibrated using a steel measuring tape. The water level probe will be disinfected with a 1:1 methanol solution and triple rinsed with distilled water prior to use in each well. All measurements will be taken from a marked, surveyed point on the top of the well casing. Each measurement record will include the date, time, and initials of the operator and will be recorded on a Well Data Sheet (see Appendix F). Water level measurements taken for a single data set will be obtained over as short a time period as possible to reduce the potential influence of water level fluctuations.

4.7 TASK 7 - TIDAL STUDY

The effects of tidal cycles on ground water elevations will be assessed by taking depth-to-water level measurements over a 24-hour period and published tidal data. Water level measurements will be taken in proposed deep monitoring well CP-108B and proposed shallow well 108A. Water level measurements will also be taken concurrently for 6 hours in proposed deep well CP-104B and proposed shallow wells, CP-107A, CP-108A and CP-109A. Measurements will be taken using a Hermit Environmental Datalogger Model SE 1000B with 10 psi transducers and an electric water level detector. Data will be plotted as ground water elevations against time (minutes), and used to determine, if present, the amount of cyclical fluctuations.

4.8 TASK 8 - EXISTING WELL CLOSURE

An existing well, B-101, located in the southeast corner of the property will be closed after completion of two new replacement wells (CP-108A and CP-108B). The closure will be accomplished by redrilling the borehole with a 6-inch hollow stem auger drill rig, pulling the casing, and grouting the entire depth of the borehole. A bentonite grout will be injected into the borehole with a tremie pipe.

4.9 TASK 9 - FINAL REPORT

Upon completion of all field activities and receipt by SE/E of all laboratory test results, SE/E will prepare a final report documenting findings of the Pier 91 Phase II Hydrogeologic Investigation. The report will include information on the following:

- Field procedures
- Soils and ground water sampling results
- Ground water elevations
- Site maps, cross-sections, piezometric maps etc.
- Findings and conclusions

5.0 DATA MANAGEMENT/LABORATORY QA/QC

The primary analytical laboratories to be used in this project are Columbia Analytical Services, Incorporated (CAS), Lonvgiew, Washington, and Analytical Resources Incorporated (ARI), Seattle, Washington. The Quality Assurance Plans employed by CAS and ARI are included in Appendix G. These plans provide details on relevant equipment, personnel, QA/QC checks, and other elements necessary to the QAPP.

5.1 DATA MANAGEMENT, REDUCTION, VALIDATION AND REPORTING

A project-specific Data Management Plan has been prepared to address issues related to data sources, data processing, and data evaluation (Appendix H). Raw data generated in the field or received from analytical laboratories will be validated in the office, entered into a computerized data base, and verified for consistency and correctness.

Criteria for analytical data validation/verification include checks for internal consistency, transmittal errors, laboratory protocol and quality control, and overall adherence to the QAPP. Quality control sample results and information documented on field sampling forms will be used to interpret and evaluate laboratory analytical results.

Laboratory validation procedures will conform, where applicable, to the Laboratory Validation Functional Guidelines for Evaluating Organics Analysis (USEPA, February 1, 1988). Data validation will incorporate the following elements:

- Double checking computerized data base entry
- Preliminary data proofing for anomalies; investigation and corrections where possible

- Proofing of laboratory data sheets for detection limits, holding times, surrogate recovery performance, and spike recovery performance.

5.2 DATA PRECISION, ACCURACY AND COMPLETENESS

Precision

Precision is a measure of data variation when more than one measurement is taken on the same sample. The precision estimate for duplicate measurements can be expressed as the relative percent difference (RPD):

$$RPD = \frac{(c_1 - c_2) \times 100}{c}$$

where

c_1 = concentration for replicate #1

c_2 = concentration for replicate #2

c = mean concentration

Acceptable precision limits are based on past data bases, as defined by the EPA. Laboratory duplicate measurements will be obtained once per round of ground water samples.

Accuracy

Accuracy of laboratory analysis is assessed by measuring standard reference material and spiked samples. Standard reference materials are utilized to calibrate laboratory measurement instruments.

Spike recovery is determined by splitting a sample into two portions, spiking one portion with a known quantity of a constituent of interest, and analyzing both portions. Spike recovery is expressed as percent recovery:

$$\text{Percent Recovery} = \frac{c}{c_s} \times 100$$

where

c = measured concentration increase

c_s = known concentration increase

Acceptable spike recovery limits are based on past data sets as defined by EPA.

Completeness

Completeness is an estimate of the amount of valid data obtained from the analytical measurement system for a given set of data. The percent completeness is defined as the number of samples analyzed that meet the data quality goals divided by the total number of samples analyzed multiplied by 100.

5.3 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits are designed to assess the capability and reliability of the measurement systems.

An on-site review of field quality assurance procedures will be conducted by a Sweet-Edwards/EMCON field operations QA officer. The SE/E QA officer will observe and document field activities and present findings/recommendations to the Project Manager in short progress reports. Throughout the project, appropriate auditor recommendations will be incorporated into field procedures at the discretion of the Project Manager.

Analytical laboratories contracted for this study will be required to participate in performance and system audits conducted by the National Enforcement Investigating Center (NEIC) or consistent with the USEPA Environmental Monitoring Systems/

Supporting Laboratories. The results of these audits will be made available to the Chemical QA Coordinator and the Project Manager.

5.4 CORRECTIVE ACTION

Corrective action measures generally lie within three areas of project management: 1) concerns associated with sample collection, sample handling, and equipment failures; 2) data processing, data management, and/or data analysis; and 3) non-conformance or non-compliance of analytical laboratories with QA requirements.

The SE/E Project Manager will be kept informed of all potentially major quality assurance problems by the Chemical QA Coordinator and the Data Management Officer. The Data Management Officer will be notified immediately by telephone should a field or laboratory quality assurance problem arise that may potentially jeopardize the use of collected data. Corrective action will be taken by the Project Manager when field methods are determined to be inappropriate or analytical data are found to be outside predetermined limits of acceptability. Corrective actions may include procedural changes, resampling and/or additional data collection, additional performance and system audits, meeting with laboratory personnel, and, in extreme cases, obtaining a new subcontractor.

ANALYTICAL
RESOURCES
INCORPORATED

Analytical
Chemists &
Consultants

333 Ninth Ave. North
Seattle, Wa 98109-5187
(206) 621-6490

EP Toxicity Test*

	Price/Sample (includes preparation) Water	Soil	Technique
Metals: As,Ba,Cd,Cr,Pb,Hg,Se,Ag	$110	$175	ICP/AAS
Pesticides: Endrin, Lindane, Methoxychlor,Toxaphene	$120	$185	GC-ECD
Herbicides: 2,4-D, 2,4,5-TP (Silvex)	$120	$195	GC-ECD
Pesticide/Herbicide Combined:	$195	$265	GC-ECD
Sample Preparation: (Included)		$75	
Total EP Toxicity:	$275	$340	ICP/AAS+ GC-ECD

*Additional Charge For TCLP Test.

urban run-off analysis; ground water monitoring and modeling; and a Section 314 Clean Lakes studies. In other work for L-COG and Lane County, Mr. Rosenthal was a water quality specialist involved in a wide range of efforts related to point and non-point pollution and was also responsible for the design, construction, and outfitting of a regional water quality laboratory.

Mr. Rosenthal's education in chemistry, hydrology and engineering, and his hands-on experience in all aspects of computer manipulation and modeling as well as study design and field work, laboratory testing, data analysis, and report preparation provides him with the expertise necessary to work in environmental chemistry, hydrology, and geochemistry. He continues to strive for excellence in developing his abilities through attendance and participation at numerous short courses and seminars.

PUBLICATIONS AND PRESENTATIONS:

1. "Preliminary Lane County General Plan WATER QUALITY REPORT," Lane Council of Governments and Lane County Water Pollution Control Division, Eugene, Oregon, 1974.
2. "An Automated Analysis Technique for Proteoglycans," Journal of Connective Tissue Research, 1976, Dr. J. Peter Bentley, principal author.
3. "208 Wastewater Management Program - Summary Report," for Lane Council of Governments 208 Program, Eugene, Oregon, January 1978.
4. "Urban Storm Runoff Management Study - Summary Report," for the Lane Council of Governments 208 Program, Eugene, Oregon, January 1978.
5. "Upper Willamette River Basin Industrial Wastes Study," for the Lane Council of Governments 208 Program, Eugene, oregon, February 1978.
6. "Comprehensive Sewerage Facility Review," for the Lane Council of Governments 208 Program, Eugene, Oregon, April 1978.
7. "Regional Pooling of Sewage Treatment and Maintenance for the Willamette Drainage area of Lane County, Oregon," September 1978, with Mr. Roger Sinclair, R.P.E. for the L-COG 208 Program.
8. "River Road/Santa Clara Ground Water Study - Final Technical Report," for the L-COG 208 Program, Eugene, Oregon, February, 1980, with Sweet, Edwards & Associates, Inc.
9. "North Florence Dunal Aquifer Study - Seismic Survey Subreport," for the L-COG 208 Program, Lane County Environmental Health and the Oregon Department of Environmental Quality, April 1980, with the OSU Geophysics Group, Corvallis.
10. "River Road/Santa Clara Groundwater Study - Final Summary Report," for the Lane Council of Governments 208 Program, Eugene, Oregon, June 18, 1980.
11. "Lane County General Plan - Working Paper #6, Water Resources" (draft), special contract for Lane County Environmental Management Division, July 1981.
12. "North Florence Dunal Aquifer Study," Lane Council of Government, Eugene, Oregon, June 1982.
13. "Nationwide Urban Runoff Program Study for Eugene-Springfield, Oregon, Eugene, Oregon, 1982.
14. "Fern Ridge Reservoir - Clean Lakes Study," Lane Council of Governments, Eugene, Oregon, 1985.
15. "Hillslope Runoff Mechanisms During Snowmelt at Hubbard Brook Experimental Forest, New Hampshire," Thesis, Cornell University, 1985.
16. "RCRA Permitting: ACLs, Trichloroethylene and Pentachlorophenol Case Histories," at Petroleum Hydrocarbons and Organic Chemicals in Ground Water - Prevention, Detection and Restoration Conference for National Water Well Association and American Petroleum Institute, Houston, Texas, November 1985, with J.E. Edwards.
17. "Organic Contamination of Groundwater in the Northwest," Presentation to the 53rd Pacific Northwest Pollution Control Association, Portland, Oregon, November 3-5, 1986.
18. "Introduction to Hazardous Waste-Characteristics and Subsurface Behavior of Contaminants in Washington State," Association of Engineering Geologists, 1989 Centennial Volume on Engineering Geology in the State of Washington, in press.
19. "Water Quality Management Plan for the Methow Valley," Presentation to the 54th Pacific Northwest Pollution Control Association, Spokane, Washington, October 1987.
20. "Water Level Monitoring - Achievable Accuracy and Precision," ASTM Symposium on Standards Development for Ground Water and Vadose Zone Monitoring Investigations, Albuquerque, New Mexico, January 28, 1988, with H.R. Sweet and D. Atwood-Fisher.

Appendix A

RESUMES

DENNIS GOLDMAN

Manager Hydrogeology

EDUCATION:

B.S. in Mathematics
University of Illinois
M.S. in Computer Science
University of Illinois
M.S. in Hydrogeology
University of Idaho
Ph.D. in Geology
University of Idaho

REGISTRATION:

Registered Professional Geologist

EXPERIENCE:

Dr. Goldman is the senior Project Manager for hydrogeology and hazardous waste related projects in Sweet-Edwards' Redmond, Washington office. In that capacity he manages site investigations, monitoring system design and installation, data interpretation and reporting, as well as federal and state permit applications at hazardous and solid waste facilities.

Before joining Sweet-Edwards, Dr. Goldman was employed by Dames and Moore in Seattle for two years. He was responsible for line management and technical direction of the geologic and hydrologic technical staff. Major projects in the Pacific Northwest (including Alaska) dealt with the implementation of RCRA monitoring systems; design, implementation and evaluation of aqueous geochemical programs; interpretation and implementation of federal and state regulations; as well as project and cost management. Specific projects included: characterization of complex hydrogeologic environments, characterization of industrial site/property transfers, interfacing with federal and state agencies, fuel spills and commercial hazardous disposal sites.

For three years Dr. Goldman was employed by Golder Associates in Vancouver, British Columbia. With Golder, he provided technical direction of the western Canadian hydrogeological staff and client/project development. Technical projects included micro-computer software development, project technical and cost management, the design and implementation of field studies and the analysis and reporting of results. Many projects involved complex hydrogeological environments such as very low hydraulic conductivity materials or fracture

hydrogeology. Projects included: water supply, dewatering/depressuring, landfill leachate analysis and mitigation, petrochemical leachate assessment, deep well injection of hazardous waste, coal hydrogeology and environmental assessment. Three months were spent in mainland China developing a coal mine.

For six years Dr. Goldman was employed by EG&G Idaho Inc., a prime contractor to the Department of Energy. With EG&G, Dr. Goldman supervised a staff of hydrogeologists and geologists involved in research and applications in the fields of geothermal reservoir engineering and waste management. He directed research in computer modeling of fractured reservoirs, borehole geophysics interpretations in metamorphic and igneous rocks, geothermal reservoir instrumentation, testing and analysis and development of low-temperature thermal systems. Field assignments included supervision of drilling, well logging, well testing, well field design, monitoring and planning, reconnaissance and public relations.

During his three years at Leggette, Brashears and Graham Inc. in New York and Florida, Dr. Goldman was involved in well site selection, supervision of drilling, well construction, geophysical well logging, well testing and related work. Projects included: mine dewatering, groundwater pollution, groundwater/surface water interference, injection modeling, well field design and development, landfill leachate studies, well testing and water law problems.

Dr. Goldman's strong academic background and more than 15 years of experience in a wide range of hydrogeologic and water quality work provide a strong foundation for project design, management, and timely completion. His expertise compliments that of other Sweet-Edwards scientists and his guidance assures appropriate actions by field staff.

MEMBERSHIP

Association of Ground Water Scientists and Engineers (NWWA)

PUBLICATIONS AND PRESENTATIONS:

1. "Refinements of Geologic Age and Geographic Locations for Apparent Polar - Wandering," M.S. Thesis, University of Illinois, Urbana, Illinois, 1971.

2. "Application of a Mathematical Groundwater Modeling Technique," M.S. Thesis, University of Idaho, Moscow, Idaho, 1974.

3. "Analysis of the Legal Constraints on Groundwater Resource Development in Idaho, Idaho Bureau of Mines and Geology," Phamplet No. 158, Moscow, Idaho, 1974, with other authors.

4. "Studies on the 3-Well Reservoir System in Raft River," Edited by Ramey, J., and Kruger, P., Second Workshop on Geothermal Reservoir Engineering, Stanford University Press, Stanford, California, 1976, with other authors.

5. "Heat Transfer in Formation as a Geothermal Reservoir Engineering Tool," Contributed by Heat Transfer Division of ASME for presentation at AICHE-ACME Heat Transfer Conference, Reprint Publication of ASME No. 77-hp-88, New York, N.Y., 1977, with other authors.

6. "The Boise, Idaho Geothermal Reservoir," edited by Kruger, P. and Ramey, H., Proceedings of Third Workshop on Geothermal Reservoir Engineering, Stanford University Press, Stanford, California, 1977, with other authors.

7. "Data Collection and Evaluation of Combined Fractured and Porous Media Flow in a Fluid-Dominated Geothermal System," presented at the National Water Well Association Convention, Oklahoma City, Oklahoma, October 1979, with other authors.

8. "Evaluation of Testing and Reservoir Parameters in Geothermal Wells at Raft River and Boise, Idaho," presented at the Ninth Annual Rocky Mountain Groundwater Conference, Reno, Nevada, October 1979, with other authors.

9. "Behavior of the Temperature and Concentration of the Shallow Groundwater in the Raft River Geothermal Area, presented at Modeling, Policy and Decision in Energy Systems Conference, sponsored by the Atomic Energy Commission of Canada, Montreal, Canada, 1980, with other authors.

10. "Numerical Simulation of the Impact of Fluid Injection in the Raft River Geothermal Area," Geothermal Resources Council Transactions No.4, 1980, with S.G. Spencer.

11. "Testing and Analysis of Low-Temperature Hydrothermal Reservoirs," Proceedings of the National Conference on Renewable Energy Technologies, December 7-11, 1980, Honolulu, Hawaii, 1980, with S. Petty.

12. "Development of a Low-Temperature Hydrothermal Energy Resource," Ph.D. Dissertation, University of Idaho, Moscow, Idaho, 1982.

JAMES S. BAILEY
Project Hydrogeologist

Experience

Mr. Bailey is a Project Hydrogeologist for Sweet-Edwards/EMCON's Seattle office. His responsibilities include the planning and implementation of hydrogeologic field investigations, performance of detailed ground water contamination studies involving water quality sampling and hydrogeologic analyses for solid and hazardous waste facilities. He has participated in the evaluation of potential sludge disposal sites and in several water supply projects for government agencies, Mr. Bailey is also involved in the preparation of numerous technical reports and in the computer modeling of ground water flow and contaminant capture.

Prior to joining Sweet-Edwards/EMCON, Mr. Bailey conducted a number of hydrogeochemical investigations for a fifty square mile watershed in the Wallowa Mountains of Oregon. He also performed a geochemical evaluation of copper contamination in streams around Gold Hill, Idaho, which was once an active mining area. In Idaho's Lewiston Basin, he delineated a subsurface ground water flow barrier using magnetic survey techniques.

Selected Projects

- Project Manager for the geologic investigation for landfill operation and closure plans at the Port Townsend Landfill, Port Townsend, WA. The project involved completion of 31 geologic exploration borings, collection and analysis of subsurface materials and installation of gas monitoring probes.

- Coordinated and performed field investigations and data evaluation for an EPA mandated study at HYTEK Finishes, Kent, WA. The study defined the nature and extent of hazardous waste contamination in soil and ground water at the site.

- Assistant Project Manager for Gig Harbor Peninsula's ground water management program in Pierce County, WA. Project involves characterizing the Peninsula's land use activities and hydrogeology sufficient to develop a sound ground water management program. Coordinating the work of five subcontractors requires careful budget tracking.

- Project Hydrogeologist for a site characterization and remedial feasibility study and closure plan at Hobart Landfill, King County, WA. Project involved installation of 23 ground water monitoring wells, water quality sampling, storm flow gauging, aquifer analysis and initial geologic hydrogeologic assessment of slurry wall feasibility.

- Assisted in the development of a water supply well field for the City of Coupeville, Island County, WA. Work included supervision of well drilling, construction and development. Additional responsibilities included pump testing and analysis and technical report preparation.

- Project Hydrogeologist for a hydrogeologic site characterization for a landfill operations/closure plan at Inman Landfill, Skagit County, WA. Project work involved supervising the drilling and construction of 13 monitoring wells and 15 gas probes. Additional work included instructing Skagit County Health Department personnel in ground water quality sampling techniques and protocol.

Education

B.S. in Biology
University of North Carolina at Greensboro
M.S. in Hydrogeology
Washington State University

Professional Registration and Affiliations

Geologist-in-Training, Idaho
Association of Ground Water Scientists and Engineers
Association of Engineering Geologists

Publications and Presentations

"Hydrogeologic Characterization of a Rural Landfill for Compliance Operation and Closure Design," 1987; Association of Engineering Geologists Centennial Volume, 1989; with P.R. Rowland (in press).

"Rural Landfill Site Characterization, Public Health Assessment and Remedial Actions," National Water Well Association Symposium, Focus: Conference on Northwestern Ground Water Issues, Portland, Oregon, Proceedings of the NWWA Focus Conference, May 5, 1987.

"A Hydrogeochemical Analysis of Ground Water in the Wallowa Mountains, Northeast Oregon," 1984, M.S. Thesis, Washington State University, Pullman, WA.

GERRITT ROSENTHAL
Manager Environmental Services

EDUCATION:

B.S. in Chemistry
Reed College, Portland, Oregon
M.S. Biochemistry/Organic Chemistry
University of Minnesota, Minneapolis
M.S. Hydrologic Engineering
Cornell University, Ithaca, New York

EXPERIENCE:

Gerritt Rosenthal is an environmental chemist/hydrologist at Sweet, Edwards & Associates, Inc. His responsibilities include project management and the evaluation of water quality, hydrologic and geochemical conditions. This includes hydrologic and associated waste disposal geochemical modeling and risk assessment as well as supervision of QA/QC procedures in sampling and in the computerized statistical analyses of data. His background provides him with the skills to deal with both inorganic and organic waste streams and with associated surface and ground water contamination investigations, exposure/risk assessment, remedial action planning, and clean-up performance.

During the last two years, Mr. Rosenthal has managed or participated in a wide variety of projects including regional aquifer studies, hazardous waste disposal evaluations, ground and surface water hydrology investigations and landfill surveys. He has also appeared as an expert witness regarding chemical data evaluation and has authored papers and presented talks on subsurface organic contamination evaluations.

Immediately prior to joining Sweet-Edwards, Mr. Rosenthal was in a hydrologic engineering program at Cornell University. He was a research assistant on an EPA/North Carolina State acid rain study at Hubbard Brook Experimental Forest in New Hampshire. His research efforts and subsequent M.S. thesis involved the analysis of surface and ground water interaction, hydrologically and chemically, during the spring melt runoff.

Before entering Cornell for graduate work, Mr. Rosenthal was the Section 208 Program Manager in Eugene, Oregon for the Lane Council of Governments (L-COG) Water Resources Planning Programs. He was responsible for program initiation and design, budgeting, personnel direction, contract management, data evaluation, and report preparation. Programs included sewerage planning and onsite waste disposal system evaluation;

Appendix B

WELL RECORD SHEETS/
BENEFICIAL USE SURVEY

Sweet, Edwards & Associates, Inc. • P.O. Box 328 • Kelso, WA 98626

Field Well Record

WELL No. _____
PROJECT

Owner of record _____ State No. _____
Tenant _____ Other No. _____
Address _____
Type Community ☐ Domestic ☐ Irrigation ☐ Monitor ☐ Other _____
Location County _____ Basin _____
U.S.G.S. Quad. _____ ___¼ ___¼ ___¼ Sec.___ T___ R___ W.M.
Description _____

Measuring point elev.____ ft./datum _____/description _____
which is____ft. above / below land surface, determined from _____
Ground elev.____ft. D.T.W.____ft. Potentiometric elev.____ft. Well depth____ft.
Condition _____ Casing dia.____in.
Perforations/Screen _____
Chief Aquifer _____ Depth to Aq. top____ft./bot.____ft.
Type of material _____ Perm. rating____ Thickness____ft.
Gravel packed? Yes ☐ No ☐ Depth to Gr. top____ft./bot.____ft. Seal _____

Driller _____
Date drilled _____ Method _____
Log filed? Yes ☐ No ☐ Open ☐ Conf. ☐

Pump Yield____gpm Pumping level____ft.
Type_____ Make_____ H.P.____

Water Analysis Primary ☐ Secondary ☐
Priority ☐ Other _____
Water levels available? Yes ☐ No ☐
Period of Record: Begin_____ End_____
Collecting agency _____
Prod. Rec.____ Pump Test____ Yield____

Sketch

Remarks _____

Recorded by: _____ Date: _____

SEA-200-01a

Appendix C

BORING LOG

Sweet, Edwards & Associates, Inc.

BORING LOG

PROJECT _____ Page ___ of ___

Location _____ Boring No. _____

Surface Elevation _____ Drilling Method _____

Total Depth _____ Drilled By _____

Date Completed _____ Logged By _____

WELL DETAILS	PENE-TRATION TIME/ RATE	DEPTH (FEET)	SAMPLE		PERME-ABILITY TESTING	SYMBOL	LITHOLOGIC DESCRIPTION	WATER QUALITY
			NO.	TYPE				

SEA-300-02a

Appendix D

CHAIN OF CUSTODY/FIELD SAMPLING DATA FORMS

Sweet, Edwards & Associates, Inc.
Kelso, WA (206) 423-3580
Redmond, WA (206) 881-0415

Field Sampling Data

LOCATION/ADDRESS _____
PROJECT NAME _____ # _____
CLIENT/CONTACT _____

Well or Surface Site Number _____
Sample Designation _____
Date, Time _____
Weather _____

HYDROLOGY MEASUREMENTS:

(Nearest .01 ft.)	Elevation	Date, Time	Method Used (M-Scope Number or Other)

WELL EVACUATION:

Gallons	Pore Volumes	Method Used	Rinse Method	Date, Time

Surface Water Flow Speed _____ Measurement Method _____ Date, Time _____

SAMPLING:

Sample	Date, Time	Method	Volume (ml)	Container Type	Depth Taken (feet)	Field Filtered (yes,no)	Preserva-tive	Iced (yes,no)	Sampler Cleaning Method
									Non-Phosphatic detergent wash H2O rinse MeOH rinse Distilled H2O rinse

FIELD WATER QUALITY TESTS:

Pore Vol. Number	pH	Conductivity	Temp	Eh				

NOTES:

Total # of Bottles: _____ Signature: _____

SEA-400-01

Sweet-Edwards / EMCON, Inc.
Kelso, WA (206) 423-3580
Redmond, WA (206) 881-0415

Chain of Custody / Laboratory Analysis Request

DATE _____ PAGE _____ OF _____

PROJECT _____ # _____

CLIENT INFO.
CONTACT _____

ADDRESS _____

TELEPHONE# _____

SAMPLERS NAME _____ PHONE# _____

SAMPLERS SIGNATURE _____

SAMPLE I.D.	DATE	TIME	LAB I.D.	TYPE	BASE/NEU/ACID ORGAN. GC/MS/625/8270	VOLATILE ORGANICS GC/MS/624/8240	HALOGENATED VOLATILE ORGANICS 601/8010	PHENOLICS 604/8040	POLYNUCLEAR AROMATIC 610/8310	TOTAL ORGANIC CARBON (TOC) 415/9060	TOTAL ORGANIC HALIDE (TOX) 9020	EP TOX/TCLP METALS (Circle One)	METALS (TOTAL) (See Special Inst.)	TCLP ORGANICS	pH, COND ALK	NO_3/NO_2, Cl SO_4	Ca, Mg, Na, K						NUMBER OF CONTAINERS
1.																							
2.																							
3.																							
4.																							
5.																							
6.																							
7.																							
8.																							

ANALYSIS REQUESTED — GENERAL CHEMISTRY (Specify) — OTHER (Specify)

Relinquished By Sweet, Edwards & Assoc.	Relinquished By	Relinquished By	PROJECT INFORMATION	SAMPLE RECEIPT
Signature	Signature	Signature		
Printed Name	Printed Name	Printed Name	Shipping I.D. No.	Total No. of Containers
Firm	Firm	Firm	VIA	Chain of Custody Seals
Date/Time	Date/Time	Date/Time	Project	Received in good condition
				LAB NO.
Received By	**Received By**	**Received By**	**SPECIAL INSTRUCTIONS/COMMENTS**	
Signature	Signature	Signature		
Printed Name	Printed Name	Printed Name		
Firm	Firm	Firm		
Date/Time	Date/Time	Date/Time		

DISTRIBUTION WHITE return to originator YELLOW lab PINK retained by originator

Appendix E

PHOTOGRAPHY LOG

PROJECT PHOTO LOG

Sweet, Edwards & Associates, Inc.

Sheet ____ of ____

PROJECT NO: _____

PROJECT NAME: _____

PROJECT LOCATION: _____

CLIENT: _____

PHOTOGRAPHER: _____

Slides ____ Prints ____ Negatives ____

SITE CATEGORY (CHECK ONE):

- ☐ Chemical Plant
- ☐ Sanitary Landfill
- ☐ Sludge
- ☐ Hazardous Waste
- ☐ Fabrication Facility
- ☐ Water Supply
- ☐ Woodwaste
- ☐ Wood Treatment
- ☐ Light Industry
- ☐ Metal Plating
- ☐ Other _____

TYPE OF WORK:

Geotechnical Exploration
- ☐ Test Pits
- ☐ Drilling
- ☐ Mapping
- ☐ Waste Characterization

Water Quality Monitoring
- ☐ Drilling
- ☐ Well Installation
- ☐ Ground Water Sampling
- ☐ K-testing
- ☐ Surface Monitoring
- ☐ Surface Sampling

Gas Monitoring
- ☐ Drilling
- ☐ Well Installation
- ☐ Recovery Systems
- ☐ Sampling

Water Supply
- ☐ Drilling
- ☐ Well Installation
- ☐ Aquifer Testing
- ☐ Sampling
- ☐ Pump Installation

Other

PHOTO NO.	DATE	DESCRIPTION

PHOTO NO.	DATE	DESCRIPTION

Appendix F

WELL DATA SHEET

WELL DATA AND GROUND WATER FIELD MEASUREMENTS

Well No. _____
Well location _____
Well casing diameter _____

Top of well casing elev. _____
Surveyed: Yes ___ No. ___

Ground surface elev. _____
Surveyed: Yes ___ No. ___
Estimate from: _____

Total depth of well (casing & screen)
Measured from g.s. _____
Measured from T.O.C. _____

Well screen interval:
Depth/elevation
Measured from T.O.C. _____

Well casing stickup
above g.s. _____

Security casing stickup
above g.s. _____

Water level measurement
point _____

Located _____ feet above g

Chief aquifer _____

FIELD MEASUREMENTS

Date	Time	Depth to water	Water elev.	Measuring device/no.	pH	Conduc-tivity	Water temp.	Remarks

Appendix G

ANALYTICAL RESOURCES, INC.
AND
COLUMBIA ANALYTICAL SERVICES
STATEMENT OF QUALIFICATIONS

ANALYTICAL RESOURCES INCORPORATED

ANALYTICAL
RESOURCES
INCORPORATED

Analytical
Chemists &
Consultants

333 Ninth Ave. North
Seattle, Wa 98109-5187
(206)621-6490

Arthur G. Hedley (Inorganic Laboratory Supervisor): (B.S. Chemistry 1976 - State University of NY, Buffalo, NY) Research chemist for U.S. Geological Survey/Water Resources Division (8 yrs), senior chemist at Metro (1 yr).Experienced in wet and intrumental analytical techniques including Graphite Furnace Atomic Absorption, Inductivity-Coupled Plasma Atomic Emission, X-Ray Fluorenscence, and Ion Chromatography, member of the American Chemical Society, author and co-author of 5 journal publications on the determination of trace inorganics in environmental waters.

Elizabeth A. Anderson (Senior Chemist): (B.S. Biology 1986 - Washington State University, Pullman, WA) Senior Chemist at Amtest (4 yrs), Lab technician at Oberto Sausage Co. (1 yr) Student Lab technician at University of Washington Hospital (3 mo).

Bryan D. Anderson (Chemist/Laboratory Technician): (B.S. in Chemistry, Central Washinton University, Ellensburg, WA) Labortory technician/Chemist at Amtest (2 yr), Field experience for Kittitas County Environmental Health Department (3 mo).

Nguyet-Anh Thi-Bui (Chemist/Laboratory Technician): (B.A. in Chemistry at University of Washington, Seattle, WA) Chemist/Analyst for City of Tacoma Public Works/Sewer Utility Laboratory (3 yr), research assistant at Environmental Intern Program, Pacific Northwest (1 yr), laboratory technician at Western Farmer's Association, Research and Quality Control (2 yr).

Lovel A. Cortez (Laboratory Technician): (B.S. in Chemistry Adamson University, Manila, P.I.)Laboratory Technician at Oberto Sausage Company (1 yr), high school instructor in science and mathemetics (4 yr).

Rebecca Campestrini (Laboratory Technician): A.A. in Biological Technology Program - Shorline Community College.

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Instrumentation

February 1988

(FINN I) Finnigan 4000 Model Y021 (1984) - with NOVA 4X data system, dual terminals, EPA/NIH 39,000 compound library, and a Tekmar Purge and Trap LSC III. GC/MS equipped with split/splitless capillary injector, glass jet separatory and solid probe. Nine-track tape drive and for matter. Extensive in-house replacement parts are available including all spare boards that may require replacement. All service maintenance is performed in-house. Any replacement parts not kept in-house are available to ARI within three days.

(FINN II) Finnigan 4000 (1985) - with NOVA 4X data system, dual terminals, EPA/NIH 39,000 compound library, and Hewlett Packard 5790 GC. GC/MS equipped with split/splitless capillary injector and solid probe. Nine-track Kennedy 9600 tape drive and formatter.

(FINN III) Finnigan MAT Incos 50 (1987) - with Superincos data system, 70 Mb Winchester-type disk drive, 5 1/4" 360 Kb floppy disk drive, Superincos software and AutoQuan™ automated target compound analysis, Varian 3400 GC, Tekmar 4000 and Tekmar ALS.

Hewlett Packard 5880A (1985) - dual ECD detectors. Both packed and capillary injectors, auto-sampler and integrator.

Hewlett Packard 5890 (1986) - dual ECD detector with HD 3392 and HD 3393 integrators. Both packed and capillary injectors and auto-sampler.

Hewlett Package 5890 (1987)- single FID detector single NPD detector and 3393 integrator. Dual capillary injectors and auto-sampler.

Gel Permeation Chromatography (1985) - Waters pump and Waters Refractive Index Detector, used for clean-up of samples before analysis.

Gel Permeation Chromatography (1987) - With UV detector for sample clean-up and PNA screening.

Centrifuge (1987)- Beckman Model GP with swinging bucket rotor and inserts for 250 ml bottles and scintillation vials.

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Instrumentation Laboratory Video 22 AAS (1987) - A dual beam, dual channel atomic absorption spectrophotometer equipped with Smith-Hieftje background correction. The instrument is interfaced to an IBM-compatible PC for data handling.

Instrumentation Laboratory CTF 188 (1987)- A computer controlled graphite furnace with an autosampler and the FASTAC aerosol deposition system.

Buck mercury analyzer (1987) - An instrument designed specifically for the cold vapor atomic absorption analysis of trace levels of mercury. It is interfaced to an IBM-compatible PC for data reduction.

Thermo Jarrell Ash ICAP 61 - A 30+ element simultaneous inductively coupled argon plasma spectrometer. It is interfaced to an IBM AT computer for instrument control and data management. The estimated date of shipment is March, 1988.

Dohrmann Model DC-180 (1988)- Total Organics Carbon (TOC) analyzer. Includes auto sampler for water analysis and dot matrix printer.

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Organics Analysis Data Sheet
(Page 1)

FINN I Instrument Detection Limits
Volatile Compounds

Based on analysis of 5 mls of water

CAS Number		µg/L
74-87-3	Chloromethane	3.8
74-83-9	Bromomethane	3.1
75-01-4	Vinyl Chloride	2.0
75-00-3	Chloroethane	3.3
75-09-2	Methylene Chloride	3.5
67-64-1	Acetone	6.9
75-15-0	Carbon Disulfide	1.2
75-35-4	1,1-Dichloroethene	0.7
75-34-3	1,1-Dichloroethane	0.6
156-60-5	Trans-1,2-Dichloroethene	0.8
67-66-3	Chloroform	1.1
107-06-2	1,2-Dichloroethane	0.5
78-93-3	2-Butanone	6.2
71-55-6	1,1,1-Trichloroethane	0.6
56-23-5	Carbon Tetrachloride	0.9
108-05-4	Vinyl Acetate	3.1
75-27-4	Bromodichloromethane	0.3

CAS Number		µg/L
78-87-5	1,2-Dichloropropane	0.7
10061-02-6	Trans-1,3-Dichloropropene	1.8
79-01-6	Trichloroethene	0.6
124-48-1	Dibromochloromethane	0.7
79-00-5	1,1,2-Trichloroethane	0.7
71-43-2	Benzene	1.0
10061-01-5	cis-1,3-Dichloropropene	1.9
110-75-8	2-Chloroethylvinylether	2.7
75-25-2	Bromoform	2.5
108-10-1	4-Methyl-2-Pentanone	3.5
591-78-6	2-Hexanone	3.2
127-18-4	Tetrachloroethene	0.5
79-34-5	1,1,2,2-Tetrachloroethane	2.7
108-88-3	Toluene	0.8
108-90-7	Chlorobenzene	0.9
100-41-4	Ethylbenzene	0.8
100-42-5	Styrene	1.1
	Total Xylenes	1.8

Data Reporting Qualifiers

Value	If the result is a value greater than or equal to the detection limit, report the value
U	Indicates compound was analyzed for but not detected. Report the minimum detection limit for the sample with U based on necessary concentration/dilution action.
J	Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds or when result is less than specified DL.
NR	Analysis not required
C	This flag applies to pesticide parameters confirmed by GC/MS.
B	This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination.
K	This flag is used when the quantitated value falls above the limit of the calibration curve. Indicates a dilution has been run and submitted also in data package.
M	Analyte does not meet EPA spectral matching protocols but present in expert opinion of the analyst.

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Organics Analysis Data Sheet
(Page 1)

FINN III Instrument Detection Limits
Volatile Compounds

Based on analysis of 5 mls of water

CAS Number		µg/L
74-87-3	Chloromethane	2.9 U
74-83-9	Bromomethane	0.9 U
75-01-4	Vinyl Chloride	1.1 U
75-00-3	Chloroethane	0.9 U
75-09-2	Methylene Chloride	1.0 U
67-64-1	Acetone	0.6 U
75-15-0	Carbon Disulfide	2.0 U
75-35-4	1,1-Dichloroethene	1.3 U
75-34-3	1,1-Dichloroethane	1.1 U
156-60-5	Trans-1,2-Dichloroethene	1.1 U
156-57-2	Cis-1,2-Dichloroethene	1.2 U
67-66-3	Chloroform	0.9 U
107-06-2	1,2-Dichloroethane	0.6 U
78-93-3	2-Butanone	1.0 U
71-55-6	1,1,1-Trichloroethane	1.0 U
56-23-5	Carbon Tetrachloride	0.5 U
108-05-4	Vinyl Acetate	1.7 U
75-27-4	Bromodichloromethane	0.2 U

CAS Number		µg/L
78-87-5	1,2-Dichloropropane	0.6 U
10061-01-5	Cis-1,3-Dichloropropene	0.5 U
79-01-6	Trichloroethene	0.8 U
124-48-1	Dibromochloromethane	0.9 U
79-00-5	1,1,2-Trichloroethane	0.3 U
71-43-2	Benzene	0.4 U
10061-02-6	Trans-1,3-Dichloropropene	0.6 U
110-75-8	2-Chloroethylvinylether	1.5 U
75-25-2	Bromoform	0.3 U
108-10-1	4-Methyl-2-Pentanone	1.8 U
591-78-6	2-Hexanone	1.3 U
127-18-4	Tetrachloroethene	0.6 U
79-34-5	1,1,2,2-Tetrachloroethane	0.6 U
108-88-3	Toluene	0.6 U
108-90-7	Chlorobenzene	0.6 U
100-41-4	Ethylbenzene	1.0 U
100-42-5	Styrene	0.5 U
	Total Xylenes	1.5 U

Data Reporting Qualifiers

Value	If the result is a value greater than or equal to the detection limit, report the value.
U	Indicates compound was analyzed for but not detected at the given detection limit.
J	Indicates an estimated value when result is less than specified detection limit.
NR	Analysis not required
B	This flag is used when the analyte is found in the blank as well as a sample. Indicates possible/probable blank contamination.
K	This flag is used when quantitated value falls above the limit of the calibration curve and dilution should be run.
M	Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match parameters.

ANALYTICAL RESOURCES, INC.

3008-B 16th W.
SEATTLE, WA 98119
(206) 285-1577

ORGANICS ANALYSIS DATA SHEET
Semivolatile Compounds
FINN II
Instrument Detection Limits
(Based on Instrument DL and calculation for 1000 ml sample)

CAS Number		µg/L
8-95-2	Phenol	0.8
1-44-4	bis(2-Chloroethyl)Ether	0.9
95-57-8	2-Chlorophenol	1.0
1-73-1	1,3-Dichlorobenzene	0.3
6-46-7	1,4-Dichlorobenzene	0.9
100-51-6	Benzyl Alcohol	1.0
-50-1	1,2-Dichlorobenzene	0.2
-48-7	2-Methylphenol	1.2
39638-32-9	bis(2-chloroisopropyl)Ether	2.6
6-44-5	4-Methylphenol	0.6
1-64-7	N-Nitroso-Di-n-Propylamine	1.6
67-72-1	Hexachloroethane	1.6
-95-3	Nitrobenzene	1.1
-59-1	Isophorone	2.4
88-75-5	2-Nitrophenol	3.1
5-67-9	2,4-Dimethylphenol	2.8
-85-0	Benzoic Acid	2.9
111-91-1	bis(2-Chloroethoxy)Methane	2.4
0-83-2	2,4-Dichlorophenol	3.3
0-82-1	1,2,4-Trichlorobenzene	1.8
91-20-3	Naphthalene	3.2
6-47-8	4-Chloroaniline	1.7
-68-3	Hexachlorobutadiene	1.8
59-50-7	4-Chloro-3-Methylphenol	1.8
1-57-6	2-Methylnaphthalene	1.7
-47-4	Hexachlorocyclopentadiene	1.7
88-06-2	2,4,6-Trichlorophenol	0.6
95-95-4	2,4,5-Trichlorophenol	0.7
-58-7	2-Chloronaphthalene	0.1
88-74-4	2-Nitroaniline	3.1
131-11-3	Dimethyl Phthalate	1.0
3-96-8	Acenaphthylene	0.2
9-09-2	3-Nitroaniline	1.8

CAS Number		µg/L
83-32-9	Acenaphthene	1.1
51-28-5	2,4-Dinitrophenol	6.3
100-02-7	4-Nitrophenol	2.0
132-64-9	Dibenzofuran	1.6
121-14-2	2,4-Dinitrotoluene	1.0
606-20-2	2,6-Dinitrotoluene	2.7
84-66-2	Diethylphthalate	0.8
7005-72-3	4-Chlorophenyl-phenylether	1.4
86-73-7	Fluorene	1.2
100-01-6	4-Nitroaniline	3.7
534-52-1	4,6-Dinitro-2-Methylphenol	6.6
86-30-6	N-Nitrosodiphenylamine(1)	3.2
101-55-3	4-Bromophenyl-phenylether	1.3
118-74-1	Hexachlorobenzene	1.7
87-86-5	Pentachlorophenol	1.3
85-01-8	Phenanthrene	1.7
120-12-7	Anthracene	0.9
84-74-2	Di-n-Butylphthalate	1.5
206-44-0	Fluoranthene	3.5
129-00-0	Pyrene	3.2
85-68-7	Butylbenzylphthalate	4.0
91-94-1	3,3'-Dichlorobenzidine	1.7
56-55-3	Benzo(a)Anthracene	2.5
117-81-7	bis(2-Ethylhexyl)Phthalate	3.9
218-01-9	Chrysene	0.6
117-84-0	Di-n-Octyl Phthalate	3.3
205-99-2	Benzo(b)Fluoranthene	1.0
207-08-9	Benzo(k)Fluoranthene	4.2
50-32-8	Benzo(a)Pyrene	0.4
193-39-5	Indeno(1,2,3-cd)Pyrene	1.7
53-70-3	Dibenz(a,h)Anthracene	2.0
191-24-2	Benzo(ghi)Perylene	1.8

(1) Cannot be separated from diphenylamine

ANALYTICAL RESOURCES, INC.

3008-B 16th W.
SEATTLE, WA 98119
(206) 285-1577

Organics Analysis Data Sheet
Pesticides/PCBs
5880A
Instrument Detection Limits

(Based on instrument DL and 1000 ml sample)

CAS Number		µg/L
319-84-6	Alpha-BHC	0.02
319-85-7	Beta-BHC	0.03
319-86-8	Delta-BHC	0.03
58-89-9	Gamma-BHC (Lindane)	0.02
76-44-8	Heptachlor	0.03
309-00-2	Aldrin	0.02
1024-57-3	Heptachlor Epoxide	0.05
959-98-8	Endosulfan I	0.05
60-57-1	Dieldrin	0.05
72-55-9	4,4'-DDE	0.08
72-20-8	Endrin	0.08
33212-65-9	Enndosulfan II	0.03
72-54-8	4,4'-DDD	0.05
1031-07-8	Endosulfan Sulfate	0.10
50-29-3	4,4'-DDT	0.11
72-43-5	Methoxychlor	0.35
53494-70-5	Endrin Ketone	0.11
57-74-9	Chlordane	0.35
8001-35-2	Toxaphene	0.30
12674-11-2	Aroclor-1016	0.07
11104-28-2	Aroclor-1221	0.10
11141-16-5	Aroclor-1232	0.38
53469-21-9	Aroclor-1242	0.52
12672-29-6	Aroclor-1248	0.51
11097-69-1	Aroclor-1254	0.85
11096-82-5	Aroclor-1260	0.47

V(i) = Volume of extract injected (ul)

V(s) = Volume of water extracted (ml)

W(s) = Weight of sample extracted (gm)

V(t) = Volume of total extract (ul)

V(s) = 1000 W(s) = NA V(t)= 10000 V(i) = 2.0

ANALYTICAL
RESOURCES
INCORPORATED

Analytical
Chemists &
Consultants

333 Ninth Ave. North
Seattle, Wa 98109-5[illegible]
(206) 621-6490

Organics Analysis Data Sheet
(Page 1)

FINN I Instrument Detection Limits
Volatile Compounds

Based on 5 gm dry weight of sediment

CAS Number		µg/Kg
74-87-3	Chloromethane	3.8
74-83-9	Bromomethane	3.1
75-01-4	Vinyl Chloride	2.0
75-00-3	Chloroethane	3.3
75-09-2	Methylene Chloride	3.5
67-64-1	Acetone	6.9
75-15-0	Carbon Disulfide	1.2
75-35-4	1,1-Dichloroethene	0.7
75-34-3	1,1-Dichloroethane	0.6
156-60-5	Trans-1,2-Dichloroethene	0.8
67-66-3	Chloroform	1.1
107-06-2	1,2-Dichloroethane	0.5
78-93-3	2-Butanone	6.2
71-55-6	1,1,1-Trichloroethane	0.6
56-23-5	Carbon Tetrachloride	0.9
108-05-4	Vinyl Acetate	3.1
75-27-4	Bromodichloromethane	0.3

CAS Number		µg/Kg
78-87-5	1,2-Dichloropropane	0.7
10061-02-6	Trans-1,3-Dichloropropene	1.8
79-01-6	Trichloroethene	0.6
124-48-1	Dibromochloromethane	0.7
79-00-5	1,1,2-Trichloroethane	0.7
71-43-2	Benzene	1.0
10061-01-5	cis-1,3-Dichloropropene	1.9
110-75-8	2-Chloroethylvinylether	2.7
75-25-2	Bromoform	2.5
108-10-1	4-Methyl-2-Pentanone	3.5
591-78-6	2-Hexanone	3.2
127-18-4	Tetrachloroethene	0.5
79-34-5	1,1,2,2-Tetrachloroethane	2.7
108-88-3	Toluene	0.8
108-90-7	Chlorobenzene	0.9
100-41-4	Ethylbenzene	0.8
100-42-5	Styrene	1.1
	Total Xylenes	1.8

Data Reporting Qualifiers

Value	If the result is a value greater than or equal to the detection limit, report the value
U	Indicates compound was analyzed for but not detected. Report the minimum detection limit for the sample with U based on necessary concentration/dilution action.
J	Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds or when result is less than specified DL.
NR	Analysis not required
C	This flag applies to pesticide parameters confirmed by GC/MS.
B	This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination.
K	This flag is used when the quantitated value falls above the limit of the calibration curve. Indicates a dilution has been run and submitted also in data package.
M	Analyte does not meet EPA spectral matching protocols but present in expert opinion of the analyst.

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Organics Analysis Data Sheet
(Page 1)

FINN III Instrument Detection Limits
Volatile Compounds

Based on analysis of 5 gms of sediment

CAS Number		µg/Kg
74-87-3	Chloromethane	2.9 U
74-83-9	Bromomethane	0.9 U
75-01-4	Vinyl Chloride	1.1 U
75-00-3	Chloroethane	0.9 U
75-09-2	Methylene Chloride	1.0 U
67-64-1	Acetone	0.6 U
75-15-0	Carbon Disulfide	2.0 U
75-35-4	1,1-Dichloroethene	1.3 U
75-34-3	1,1-Dichloroethane	1.1 U
156-60-5	Trans-1,2-Dichloroethene	1.1 U
156-57-2	Cis-1,2-Dichloroethene	1.2 U
67-66-3	Chloroform	0.9 U
107-06-2	1,2-Dichloroethane	0.6 U
78-93-3	2-Butanone	1.0 U
71-55-6	1,1,1-Trichloroethane	1.0 U
56-23-5	Carbon Tetrachloride	0.5 U
108-05-4	Vinyl Acetate	1.7 U
75-27-4	Bromodichloromethane	0.2 U

CAS Number		µg/Kg
78-87-5	1,2-Dichloropropane	0.6 U
10061-01-5	Cis-1,3-Dichloropropene	0.5 U
79-01-6	Trichloroethene	0.8 U
124-48-1	Dibromochloromethane	0.9 U
79-00-5	1,1,2-Trichloroethane	0.3 U
71-43-2	Benzene	0.4 U
10061-02-6	Trans-1,3-Dichloropropene	0.6 U
110-75-8	2-Chloroethylvinylether	1.5 U
75-25-2	Bromoform	0.3 U
108-10-1	4-Methyl-2-Pentanone	1.8 U
591-78-6	2-Hexanone	1.3 U
127-18-4	Tetrachloroethene	0.6 U
79-34-5	1,1,2,2-Tetrachloroethane	0.6 U
108-88-3	Toluene	0.6 U
108-90-7	Chlorobenzene	0.6 U
100-41-4	Ethylbenzene	1.0 U
100-42-5	Styrene	0.5 U
	Total Xylenes	1.5 U

Data Reporting Qualifiers

Value	If the result is a value greater than or equal to the detection limit, report the value.
U	Indicates compound was analyzed for but not detected at the given detection limit.
J	Indicates an estimated value when result is less than specified detection limit.
NR	Analysis not required
B	This flag is used when the analyte is found in the blank as well as a sample. Indicates possible/probable blank contamination.
K	This flag is used when quantitated value falls above the limit of the calibration curve and dilution should be run.
M	Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match parameters.

ANALYTICAL RESOURCES, INC.

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ORGANICS ANALYSIS DATA SHEET
Semivolatile Compounds
FINN II
Instrument Detection Limits
(Based on Instrument DL and calculation for 30 gm sample)

CAS Number		µg/Kg
08-95-2	Phenol	13
11-44-4	bis(2-Chloroethyl)Ether	14
95-57-8	2-Chlorophenol	16
41-73-1	1,3-Dichlorobenzene	6
06-46-7	1,4-Dichlorobenzene	15
100-51-6	Benzyl Alcohol	17
95-50-1	1,2-Dichlorobenzene	4
5-48-7	2-Methylphenol	20
39638-32-9	bis(2-chloroisopropyl)Ether	43
106-44-5	4-Methylphenol	10
21-64-7	N-Nitroso-Di-n-Propylamine	26
67-72-1	Hexachloroethane	26
98-95-3	Nitrobenzene	18
3-59-1	Isophorone	39
88-75-5	2-Nitrophenol	52
105-67-9	2,4-Dimethylphenol	47
5-85-0	Benzoic Acid	49
111-91-1	bis(2-Chloroethoxy)Methane	40
120-83-2	2,4-Dichlorophenol	55
120-82-1	1,2,4-Trichlorobenzene	30
91-20-3	Naphthalene	53
106-47-8	4-Chloroaniline	29
87-68-3	Hexachlorobutadiene	30
59-50-7	4-Chloro-3-Methylphenol	31
91-57-6	2-Methylnaphthalene	29
77-47-4	Hexachlorocyclopentadiene	28
88-06-2	2,4,6-Trichlorophenol	10
95-95-4	2,4,5-Trichlorophenol	12
91-58-7	2-Chloronaphthalene	2
88-74-4	2-Nitroaniline	52
131-11-3	Dimethyl Phthalate	16
208-96-8	Acenaphthylene	3
99-09-2	3-Nitroaniline	31

CAS Number		µg/Kg
83-32-9	Acenaphthene	19
51-28-5	2,4-Dinitrophenol	105
100-02-7	4-Nitrophenol	33
132-64-9	Dibenzofuran	27
121-14-2	2,4-Dinitrotoluene	16
606-20-2	2,6-Dinitrotoluene	45
84-66-2	Diethylphthalate	13
7005-72-3	4-Chlorophenyl-phenylether	24
86-73-7	Fluorene	19
100-01-6	4-Nitroaniline	61
534-52-1	4,6-Dinitro-2-Methylphenol	110
86-30-6	N-Nitrosodiphenylamine(1)	53
101-55-3	4-Bromophenyl-phenylether	21
118-74-1	Hexachlorobenzene	29
87-86-5	Pentachlorophenol	21
85-01-8	Phenanthrene	28
120-12-7	Anthracene	15
84-74-2	Di-n-Butylphthalate	25
206-44-0	Fluoranthene	59
129-00-0	Pyrene	54
85-68-7	Butylbenzylphthalate	67
91-94-1	3,3'-Dichlorobenzidine	29
56-55-3	Benzo(a)Anthracene	42
117-81-7	bis(2-Ethylhexyl)Phthalate	64
218-01-9	Chrysene	10
117-84-0	Di-n-Octyl Phthalate	54
205-99-2	Benzo(b)Fluoranthene	17
207-08-9	Benzo(k)Fluoranthene	69
50-32-8	Benzo(a)Pyrene	7
193-39-5	Indeno(1,2,3-cd)Pyrene	29
53-70-3	Dibenz(a,h)Anthracene	34
191-24-2	Benzo(ghi)Perylene	31

(1) Cannot be separated from diphenylamine

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Organics Analysis Data Sheet
Pesticides/PCBs
5880A
Instrument Detection Limits

(Based on instrument DL and 30 gram sample)

CAS Number		ug/Kg
319-84-6	Alpha-BHC	3.1
319-85-7	Beta-BHC	4.0
319-86-8	Delta-BHC	4.3
58-89-9	Gamma-BHC (Lindane)	2.1
76-44-8	Heptachlor	4.3
309-00-2	Aldrin	3.1
1024-57-3	Heptachlor Epoxide	7.1
959-98-8	Endosulfan I	6.1
60-57-1	Dieldrin	7.2
72-55-9	4,4'-DDE	10.1
72-20-8	Endrin	10.9
33212-65-9	Enndosulfan II	3.5
72-54-8	4,4'-DDD	6.5
1031-07-8	Endosulfan Sulfate	13.5
50-29-3	4,4'-DDT	14.1
72-43-5	Methoxychlor	46.5
53494-70-5	Endrin Ketone	14.0
57-74-9	Chlordane	46.3
8001-35-2	Toxaphene	39.3
12674-11-2	Aroclor-1016	8.9
11104-28-2	Aroclor-1221	13.5
11141-16-5	Aroclor-1232	50.5
53469-21-9	Aroclor-1242	69.9
12672-29-6	Aroclor-1248	68.1
11097-69-1	Aroclor-1254	112.8
11096-82-5	Aroclor-1260	62.1

V(i) = Volume of extract injected (ul)

V(s) = Volume of water extracted (ml)

W(s) = Weight of sample extracted (gm)

V(t) = Volume of total extract (ul)

V(s) = NA W(s) = 30 V(t)= 20000 V(i) =2.0

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EPA Priority Pollutants

EPA Method		Price/Sample		Parameters	technique
Water	Soil	Water	Soil		
604	8040	$135 $275	$160 $275	Phenols	GC-FID GC/MS
608	8080	$135	$160	Chlorinated Pesticides/PCB	GC-ECD
	8140	$135	$160	Organophosphorous Pesticides	GC-NPD
610	8100	$125 $275	$150 $275	Polynuclear Aromatic Hydrocarbons	GC-FID GC/MS
612	8120	$125	$150	Chlorinated Hydrocarbons	GC-ECD
615 GC-ECD	8150	$145 $120	$160 $135	10 Chlorinated Herbicides 2,4-D 2,4,5-T 2,4,5-TP only.	GC-ECD
624	8240	$200	$225	Volatile Organics	GC/MS
625	8270	$425	$425	Semivolatile Organics	GC/MS
624/625/608 8240/8270/8080		$725	$770	Full Organic Parameters	(GC/MS + GC-ECD)
1624		$300	$325	Isotope Dilution Volatiles	GC/MS
1625		$700	$750	Isotope Dilution Semivolatiles	GC/MS
		$155 $20	$155 $30	Metals* Digestion charge (2 digestions)	AAS/ICP

*Ag.As.Be.Cd.Cr.Cu.Hg.Pb.Ni.Sb.Se.Tl.Zn

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Trace Metals

Method	*Metals*	*Price/element*
AAS (flame)	Al,Ag,Au,Ba,Be,Ca,Cd,Co,Cr,Cu,Fe,K,Mg, Mn,Mo,Na,Ni,Pb,Sb,Sn,Ti,Tl,V,Zn	$7.50
AA/Graphite Furnace	Al,Ag,As,Au,Ba,Be,Cd,Co,Cr,Cu,Fe,Mn,Mo, Ni,Pb,Sb,Se,Sn,Ti,Tl,V,Zn	$20.00
Mercury Cold Vapor	Hg	$25.00
ICP	Al,Ag,As,B,Ba,Be,Ca,Cd,Co,Cr,Cu,Fe,K,Li,Mg, Mn,Mo,Na,Ni,Pb,Sb,Se,Si,Sn,Sr,Th,Ti,Tl,U,V,W,Zn	$7.50

Sample Digestion: Water $10.00 Sediment $15.00 Tissue $20.0

Filtration:(.45u) $5.00

EP-TOX Extraction: $75.00

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Other Analytical Services

Parameter	*Price/Sample*	*technique*
TOC (total organic carbon)	$30.00	
TOX (total organic halide)	$70.00	
Oil/Grease	$35.00	Gravimetric
Pentachorophenol	$90.00	GC/ECD
STORAGE TANK SCREENING		
Total lead	$40.00	AAS
Diesel Fuel	$40.00	GC/FID (ppm)
Gasoline	$40.00	GC/FID (ppm)
BTX	$150.00	GC/MS
Tributyl-Tin	$200.00	GC/MS
PCB'S	$35.00*	GC/ECD (ppm)
	$80.00*	GC/ECD (ppb)

* Includes Alumina cleanup.

For tests not listed please inquire for quote.

COLUMBIA ANALYTICAL SERVICES

Columbia Analytical Services, Inc.

1152 3rd Avenue • Longview, WA 98632 • (206) 577-7222

QUALITY MANAGEMENT

PLAN

FOR

COLUMBIA ANALYTICAL SERVICES

INDEX FOR QUALITY MANAGEMENT PLAN

1. QUALITY ASSURANCE POLICY FOR CAS

It is the policy of Columbia Analytical Services that there should be sufficient quality assurance (QA) activities conducted within the lab to ensure that all analytical data generated and processed will be scientifically valid, of known precision and accuracy, of acceptable completeness, representativeness and comparability, and when and where appropriate, legally defensible. This goal can be achieved by ensuring that adequate quality control (QC) procedures are used throughout the monitoring process and by establishing a means to monitor and asses performance on these QC activities.

We recognize that Quality Assurance requires a commitment to quality by everyone in the organization--individually, within each operating unit and within the overall laboratory management.

2. QUALITY ASSURANCE RESPONSIBILITIES

2.1. Company Organization and Responsibilities

CAS as a whole has a responsibility for, and commitment to, excellence. We want to foster an environment that encourages excellence through a participative approach to improving and maintaining the quality of our analytical services. Everyone within CAS shares responsibility for Quality Assurance. Appendix 4.2 contains an organization chart and resumes of key personnel.

- The role of the Lab Manager is to help set laboratory goals for Quality Assurance, provide resources required to meet identified QA needs, and with staff input, evaluate QA performance against established objectives.

- The Quality Assurance Coordinator is to provide a focus for overall QA activities within the lab. This person is to work with individual operating units to establish effective quality control and assessment plans and is responsible for identifying and responding to QA needs, problems and requests from the analytical teams. This

person is a technical advisor and is responsible for summarization and reporting on overall Unit performance, including round robin programs, certification activities, and blind and reference sample analysis.

- The Sample Receiving Office plays a key role in the lab QA program through documentation of samples input to our laboratory, output of results and archiving information, acting as a library for storage of reference materials and submittal of blind and reference samples to our laboratory.

- Each analytical section is responsible for establishing, maintaining and documenting the QC program within their section based upon its unique requirements. As such, it is up to each section to implement, document and evaluate their programs. Analysts responsible for performing identified quality control procedures including analysis of references and blanks, proper equipment maintenance and calibration, analysis of control samples, and thorough documentation of QC practices. In some cases, this involves following practices that are recommended and/or required to maintain certification and/or to perform environmental analyses.

3. QUALITY ASSURANCE GUIDELINES

Quality Assurance in its practical form can be separated into several main areas. These are sampling and sample handling, analysis, instrumentation, facilities, quality control, documentation and communication.

3.1. Sample Handling and Preservation

The precision and accuracy of analytical results are strongly affected by sample handling. Improper sampling preservation techniques or holding times can cause significant errors. It is important for the analyst to work closely with the sampling personnel to assure the appropriate information is included with the sample. Factors that must be taken into account to ensure sound analytical results include:

- Amount of sample to be taken
- Type of container used for sampling
- Type of sample preservation to be used
- Sample storage time
- Complete documentation

Bound notebooks are kept which contain detailed sample descriptions (work request sheets) and a work request log summary. This information is shown in Appendix 4.1.

CAS has adopted the sample preservation, container type and holding time recommendation's published by the EPA. Chain-of-Custody procedures, as outlined by the EPA CLP program are also followed. Many samples require strict adherence to these procedures. All persons handling a sample are required to sign for it, providing a record of who had access to it. This document follows the sample from start to finish. Once started, chain-of-custody can be invalidated if not rigorously performed during the life of the sample. See Appendix 4.1 for sample handling and preservation guidelines.

3.2. Analysis Procedures

CAS generally uses "approved" analytical methods for the work performed in the laboratory. Depending upon the type of sample and nature of the work requested, various analytical techniques may be used. Typical methods used at CAS are listed below:

- EPA SW 846, Test Methods for Evaluating Solid Waste, November, 1986 Third Edition.
- EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes. March, 1979.
- EPA Contract Laboratory Program, Statement of Work for Inorganics Analysis. SOW No. 787
- Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound. TC-3991-04, March, 1986. For USEPA and USACE.

- Annual Book of ASTM Standards, Part 31 Water.

- Standard Methods for the Examination of Water and Wastewater, 15th Edition.

- 40 CFR Part 136, Guidelines for Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act. Friday, October 26, 1984.

- WDOE 83-13. Chemical Testing Methods for Complying with the State Of Washington Dangerous Waste Regulations, July, 1983.

- TAPPI Test Methods, 1988 Volume I and II. Technical Association of the Pulp and Paper Industry.

- Criteria for Identification of Hazardous and Extremely Hazardous Wastes, California Administrative Code, Title 22, Article 11.

The analytical methods used for analysis generally depend entirely upon the end use needs of our clients. It is important for our clients and the lab to understand the precision and accuracy, limitations, interferences and detection levels of the methods selected. Criteria for method selection are listed below:

- Accuracy and precision of the method. In selecting a method, the first criteria should be accuracy and precision. The method should be capable of meeting the accuracy and precision requirements desired by our clients.

- Limit of detection. The limit of detection of the method will determine whether or not the method is sensitive to the analyte at the concentration of interest. It is important to keep the limit of detection in mind when sampling since it can affect sampling procedures.

- Analysis errors. In deciding on a method and using it, attention should be paid to determining sources of error. Such things as reagent purity and stability, instrument variability and method complexity all affect the reliability of the method. The reliability of a method tends to decrease with greater complexity.

- Method description. A clear, concise description of the method is necessary. This is not only to make it easy to follow, but also to help assess sources of error. The method should be written in a standard format. It should be presented in such detail that an inexperienced analyst could, by closely following it, achieve adequate results. The method should be followed exactly as written.

- Sample matrix effects. The sample matrix can affect the choice of methods. Possible contaminants can interfere with the analyte. It is necessary to determine if the analysis will be affected by any suspected contaminants. Thus, a method should be chosen which will enhance the response of the analyte of interest.

It is important to establish achievable and tolerable error limits when deciding on a method. When using the method it is important to monitor the established limits to ensure that the method is performing as desired.

3.3. Instrument Maintenance and Calibration (Appendix 4.1)

The equipment used at CAS must be maintained and calibrated properly to ensure suitable performance. This applies to all equipment including balances, ovens, refrigerator, UV-Vis and AA spectrophotometers, ICP, GC's etc. Procedures for maintenance and calibration are specified and followed. Documentation of these activities is kept. Following is a brief description of our general maintenance practices for major pieces of equipment:

- Ovens, Incubators and Refrigerators. On a daily basis, temperatures are monitored and recorded on all of our temperature regulated equipment. A bound log book is kept that records these temperatures, the person monitoring the equipment, any problems observed and the necessary corrective action taken. This log book applies to all drying ovens, the BOD incubator, all sample storage refrigerators and water baths.

- Analytical Balances. Balances are serviced on an annual basis by a professional balance maintenance organization. On a daily basis, the analytical balance is checked with a class "S" weight. This information is kept in a daily log book.

- Water Purification System. On a routine basis, demineralized water used in the laboratory is checked for conductivity. If the conductivity reading exceeds 3 umhos/cm corrective action is taken to correct any problem. All measurements and corrective actions are recorded in a maintenance log. On an annual basis, our demineralizer system is serviced by the manufacturer.

- Emission Spectrograph (ICP). A maintenance log book is kept for the ICP that lists all maintenance activities, service calls and other actions taken to assure suitable performance. Routine calibration of the ICP involves calibrating each emission line of interest against a "0" and three standards. Analysis of calibration verification solutions, interelement interference check samples, EPA reference samples, spike and duplicate samples are performed as specified in the EPA CLP Inorganics Program, SOW No. 787.

- Atomic Absorption Spectrophotometers. The same regimen as described for the ICP is followed for the atomic absorption spectrophotometers.

- GC/MS Systems. These systems are under service and maintenance contracts with Hewlett-Packard. Analysis of blanks, standards, EPA reference samples, spikes and duplicates are performed routinely. QA/QC procedures generally follow those prescribed in EPA SW 846 protocols.

- Gas Chromatographs. Maintenance activities for the gas chromatographs are recorded in bound log books. Routine calibrations involve setting up and recording instrument parameters for specific tests being performed. Analysis of blanks, calibration standards, EPA reference samples, spikes and duplicates are performed each time a specific test procedures is ran. QA/QC procedures generally follow those prescribed in EPA SW 846 protocols.

- UV-Visible Spectrophotometer. Maintenance is performed as described in the maintenance manuals. Routine calibrations for colorimetric analyses involve analysis of 4 or 5 point calibration solutions and analysis of references spikes and duplicates.

- Other instruments, such as TOC, TOX, Chloride Titrators, IR, etc. are operated as specified in the instrument manuals for each instrument. Performance of these analytical systems is monitored through performance of EPA and other suitable reference materials.

3.4. Personnel

To provide quality results it is necessary for CAS to have the proper knowledge and skills to perform their jobs with competence. For this reason, CAS is committed to on-the-job training, attendance of personnel at seminars and training courses, and membership in professional societies, Appendix 4.2 provides resumes of our key personnel.

3.5. Facilities and Safety

The CAS lab facility has approximately 6300 square feet of work space. The laboratory is divided into separate work areas that facilitates sample throughout and minimizes the possibility of contamination. These area include:

* Shipping and Receiving (Sampling Supplies)
* Sample Receiving and Storage (Sample Mgmt.)
* Inorganic/Metals Sample Preparation Area
* ICP Laboratory
* Inorganic/Metals Instrumentation Area
* Organic Sample Preparation Area
* Organic Instrumentation Area
* GC/MS Laboratory (Part of 1988 Expansion)
* Microbiological Work Area
* Office Areas (Laboratory Management)

Each of these areas is served by heating, ventilation and air conditioning systems. This also includes safety equipment including hoods, eye washes, fire extinguishers and emergency showers and protective wear.

CAS has an ongoing safety program to protect employee health. CAS takes positive steps to insure that our procedures are not detrimental to the environment or health of employees and customers within generally accepted standards of test. CAS complies with all applicable laws and regulations relating to the health, safety, and the environment.

3.6. Quality Control

Laboratory quality control is maintained from sample receiving through final sample disposal. The QC guidelines followed at CAS as standard practice include:

* 10-20% of all samples are analyzed in duplicate and/or spiked. Each set of samples processed during the day has at least one blank, one duplicate and one matrix spike at a minimum of 10% of the sample load.

* Method blanks and calibration standards are run each time an analysis is performed. The "Reagents/Standards Quality Documentation Outline" is shown in Appendix 4.6.

* Analysis of interelement interference and matrix check samples (as per EPA CLP protocols) performed on a routine basis.

* Analysis of reference solutions, typically those provided by EPA, for most AA, ICP, wet chemistry and GC work performed at the lab.

* Secondary review of all work performed prior to release to client.

Evaluation criteria to accept or reject laboratory data generally follows the EPA CLP protocols for metals and cyanide. For wet chemistry and GC procedures, duplicates should be within 20% of the mean and

reference samples must fall within the published coefficient of variation for the EPA reference samples being analyzed. Acceptance levels for matrix spikes are shown in Appendix 4.3.

Prior to submitting analytical results to our clients, the supervising chemist will check the entire data package to insure that the data is acceptable. These checks include:

- Client requirements for precision, accuracy and detection limits

- Analytical procedure blanks, duplicates, matrix spike recoveries, and EPA QC results

- Instrument standardization and response factors

If the data is acceptable, a written report is generated and reviewed by a second chemist prior to submission to a client.

Feedback and Corrective Action

During any type of analytical procedure used in the lab, if calibration curves and control samples are outside the acceptable limits, work is to be stopped and the source of the problem is to be investigated, determined and corrected, before work is to be resumed.

All samples affected by the "out of control" procedure will be re-analyzed (Appendix 4.3.). If insufficient sample is present for a repeat analysis, the data will be reported with a qualifier - "Data failed quality assurance requirements".

CAS is participating in several reference sample programs. These include:

EPA CLP Program for Inorganics
EPA Water Pollution Laboratory Performance Program
EPA (State Of Washington) Drinking Water Performance Evaluation Study
National Voluntary Laboratory Accreditation Program for Asbestos
NIOSH PAT Program

3.7. Documentation and Standard Operating Procedures

It is vital that accurate records be kept of all activities pertinent to the production of analytical data. This includes instrument logs, calibration records, laboratory data sheets, strip charts and computer instrument printouts, chain-of-custody documentation, etc. Standard Operating Procedures (SOP's) have been developed for our EPA CLP project that document these procedures for record keeping.

To monitor and control our analytical procedures, records of calibration curves and results of reference samples are kept in log books. Routine procedures used at CAS have defined limits for precision of duplicates, recoveries of reference samples, fit of calibration curves, etc., which must be met for work to be deemed acceptable. The process for determining acceptability include:

1. Review of calibration slope and curve fit against historical data. Slope should be within 10% of historical and curve fit, for linear curves, should have an r value of 0.995 or above.

2. Review of reference value results. Reference samples, such as EPA or NBS standards have "true" values to which our experimental results are compared. Our determination must fall within the coefficient of variation published for these materials for work to be acceptable.

3. Review of duplicate results. Generally, for homogenous matrices, the precision of duplicate results should not exceed 10% of the mean value.

These reviews are made by the analyst performing the work. If criteria are not met, work is halted, problems are identified and corrected, before work is continued. The supervisor and QA/QC manager are notified and consulted with these problems and the corrective measures to be taken.

3.8. Archival of Outdated SOPs

It is important that all Standard Operating Procedures are reviewed, approved, numbered and dated before general use in the laboratory. A master file of SOPs is maintained. Each time a revision is made in an SOP, a revision number is assigned, all "old" copies of the SOPs are pulled and the new SOPs distributed. All versions of SOPs are kept in the master file.

APPENDIX 4.1

STANDARD OPERATING PROCEDURES

FOR

SAMPLE CONTAINERS, PRESERVATION, STORAGE

AND

CHAIN OF CUSTODY

1. STANDARD OPERATING PROCEDURES FOR THE DUTIES AND RESPONSIBILITIES OF SAMPLE CUSTODIAN

Duties and responsibilities of the sample custodian shall include but not be limited to:

1.1. Receiving samples

1.2. Inspecting sample shipping containers for presence/absence and condition of:

1.2.1. custody seals, locks, "evidence tape," etc.
1.2.2. container breakage and/or container integrity

1.3. Recording condition of both shipping containers and sample containers (bottles, jars, cans, etc.) in appropriate logbook.

1.4. Signing appropriate documents, shipped with samples (i.e. airbills, chain-of-custody record(s), SMO (Sample Management Office) Traffic Reports, etc.)

1.5. Verifying and recording agreement or non-agreement of information on sample documents (i.e., sample tags, chain-of-custody records, traffic reports, airbills, etc.) in appropriate logbooks or on appropriate forms. If there is non-agreement, recording the problems, notify lab manager, who will contact the SMO for direction. (SMO's corrective action directions shall be documented in the case file.)

1.6. Initiating the paper work for sample analyses on appropriate laboratory documents (including establishing case and sample files and inventory sheets) as required for analysis or according to laboratory standard operating procedures.

1.7. Marking or labeling samples with laboratory sample numbers as appropriate and cross referencing laboratory numbers to SMO numbers and sample tag numbers as appropriate.

1.8. Placing samples, sample extracts, and spent samples into appropriate storage and/or secure areas.

1.9. Controlling access to samples in storage and assuring that laboratory standard operating procedures are followed when samples are removed from and returned to storage.

1.10. Monitoring Chain-of Custody of Samples in the Laboratory by insuring that samples are stored in a locked refrigerator. Also, that the sample control record is maintained by persons authorized to handle samples.

1.11. Assuring that sample tags are removed from the sample containers and included case file. Accounting for missing tags in a memo to the file or documenting that the sample tags are actually labels attached to sample containers or were disposed of due to suspected contamination.

1.12. Monitoring storage conditions for proper sample preservation such as refrigeration temperature and prevention of cross-contamination.

1.13. Returning shipping containers to the proper sampling teams.

2. STAND OPERATING PROCEDURES FOR SAMPLE RECEIVING

2.1. Upon receipt, examine the shipping container and record the following information on sample log-in sheet.

- 2.1.1. Presence/absence of custody seal (s) on the shipping container (s)
- 2.1.2. Condition of custody seal (i.e. intact, broken, absent)

2.2. Open the shipping container, remove the enclosed sample documents and record on sample log-in sheet.

- 2.2.1. Presence/absence of the chain-of-custody record(s)
- 2.2.2. Presence/absence of SMO forms (Traffic Reports)
- 2.2.3. Presence/absence of airbills and/or bills of lading documenting shipment of samples

2.3. Remove sample containers and record in a logbook or on sample log-in sheet

- 2.3.1. Condition of samples (intact, broken, leaking, etc.)
- 2.3.2. Presence/absence of sample tags
- 2.3.3. If sample tags are present
  - 2.3.3.1. Record sample tag document control numbers
  - 2.3.3.2. Compare with chain-of custody record(s) - if tag numbers are listed, do they match the numbers on sample tags received?
  - 2.3.3.3. Document whether or not these numbers agree;
  - 2.3.3.4. If sample tag numbers are not listed on the chain-of-custody record, record this fact.

2.4. Compare the documents listed below to verify agreement of the information contained on them. document both agreement among the forms and any discrepancies found. If discrepancies are found contact lab manager who will solve with SMO. Document SMO's corrective action instructions and the source.

- 2.4.1. Chain-of custody records
- 2.4.2. Sample tags
- 2.4.3. SMO forms
- 2.4.4. Airbills or bills of lading

2.5. If all samples recorded on the chain-of-custody record were received by the lab and there are no problems observed with the sample shipment, the custodian will sign the chain-of-custody record in the "received for laboratory by:" box.

If problems are noted, sign the chain-of-custody record and then note problems in remarks box or reference other form that describes the problems in detail.

2.6. The sample custodian should assign laboratory sample numbers to samples received. These assigned numbers will be listed on the sample log-in sheet.

2.7. Samples received when the sample custodian and other designated recipients are absent should be placed in a secure, refrigerated location. The person receiving the shipping container should sign for the container (usually the airbill), place it in the secure location and record the time, date and name of individual receiving the container.

The sample custodian or their designee will log-in the samples on the next business day. The date on the receipt form will be the date the form was completed. The actual time, date and recipient name will be noted in the remarks column and the original receipt documentation will be attached to the chain-of-custody record.

2.8. Sample tags and/or other sample documents that appear to be contaminated due to sample breakage or other problems should be dried under a fume hood and be separately sealed in plastic bags prior to being placed in case files.

Note: All sample tags from designated "High-Hazard" concentration and dioxin samples should be sealed in plastic bags prior to being placed in case files.

3. STANDARD OPERATING PROCEDURES FOR SAMPLE IDENTIFICATION

3.1. In order to maintain sample identity, each sample received must have a unique sample identification (sample ID) number.

Laboratory Assigned Number

Assign laboratory number based on last 3 digits of service request number dash sequential numbers starting with 1. Place number on sample container and record on sample log-in sheet.

3.2. The sample custodian will then remove the sample tag and place it in the appropriate case file. If stick-on sample tags, this fact should be noted in the comment section of the log-in sheet. If tags are disposed of due to suspected contamination, this disposal should be noted on the sample receipt documentation.

4. STANDARD OPERATING PROCEDURES FOR SAMPLE STORAGE

4.1. That the laboratory may satisfy sample chain-of-custody requirements, the following standard operating procedures for laboratory/sample security should be implemented:

4.1.1. Samples will be stored in a secure area.
4.1.2. Access to the laboratory will be through a monitored area. Other outside-access doors to the laboratory will be kept locked.
4.1.3. Visitors will sign a visitors log and be escorted while in the laboratory.
4.1.4. Refrigerators, freezers, and other EPA sample storage areas will be securely maintained or locked.
4.1.5. Only the designated sample custodian and the supervisory personnel will have keys to locked sample storage area(s).
4.1.6. Samples will remain in secure sample storage until removed for sample preparation or analysis.
4.1.7. All transfers of samples into and out of storage will be documented on an internal chain-of-custody record.
4.1.8. These internal custody records will be maintained in the case files.

4.1.9. After a sample has been removed from storage by the analyst, the analyst is responsible for the custody of the sample. Each analyst must return the samples to the storage area before the end of the working day or prior to the end of his/her shift.

5. STANDARD OPERATING PROCEDURES FOR TRACKING SAMPLE ANALYSES

5.1. Both the preparation and the analysis of samples will be documented.

5.2. All analysts will use standard forms for recording information using one case per page.

5.3. All notebook pages, bench sheets, graphs, computer printouts, and other laboratory case related documents will contain the EPA case/sample number, date, signature (initials) of the analyst and other pertinent information.

5.4. Upon completion of analysis, data will be filed in the appropriate case or sample files.

5.5. Copies of QA/QC data will be placed in the appropriate case files.

5.6. Instrument logs will be maintained for each instrument.

5.7. Copies of the instrument logs will be placed in the appropriate case files.

5.8. Inorganic sample preparation and analysis records should be completed on a per case basis, as each step of sample preparation and analysis is completed. All sample preparation information will be documented in the analysts' laboratory notebook or other appropriate form. All sample analysis data will be documented using analyst's laboratory notebooks, bench sheets, instrument logbooks, computer printouts, strip-chart recordings, and/or other laboratory documents. When sample preparation or analysis is finished by an individual, the completed documents should be placed in the appropriate sample and/or case files.

5.9. If inorganic samples are run in batches, which may include several EPA cases, all original batch analysis results will be filed in one sample/case folder. Copies of the results will be placed in each of the other sample/case folders and there shall be a reference to the case file that contains the original analytical results documentation. Original calibration and QA/QC data should be treated in the same manner as the analytical documentation.

5.10. Cyanide, sulfide, ammonia, etc. analyses data should be recorded in laboratory notebooks and/or on bench sheets. All analytical data should be filed in the appropriate case and/or sample file.

5.11. If for any reason the original data cannot be placed in a sample/case file, this shall be documented and the location of the original data noted on the case file inventory.

5.12. All notes, comments and calculations made on or added to case related data/documents will be signed and dated by the author/analyst/reviewer.

5.13. Corrections made to any documents placed in the case files shall be made as follows:

5.13.1. Draw a single line through the incorrect data.
5.13.2. Initial and date the line.
5.13.3. Write in the correct data.

5.14. All data will be recorded in ink.

6. STANDARD OPERATING PROCEDURES FOR DATA ASSEMBLY

6.1. This procedure, preparation of case files, will ensure that all documents are compiled in one location for submission to EPA, preferably in single case files, in case number order, and are arranged by SMO sample number.

6.1.1. Using appropriate file folders, assign one folder to each case according to SMO case number.
6.1.2. Place all documents, sample tags, SMO forms, and laboratory-generated data, pertaining to one case in the folder.
6.1.3. Assembly sample data package in the following order:

6.1.3.1. "Cover Page-Inorganic Analysis Data Package" Sample traffic reports.
6.1.3.2. Inorganic Analysis Data Sheets (to include all instrument readouts) in the following order:

6.1.3.2.1. ICP
6.1.3.2.2. Flame AA-grouped by element
6.1.3.2.3. Furnace AA-grouped by element
6.1.3.2.4. Mercury
6.1.3.2.5. Cyanide

6.1.3.3. Digestion note basic logs as follows:

6.1.3.3.1. Digestion lab sheets
6.1.3.3.2. Instrument log copies
6.1.3.3.3. Sample tracking log
6.1.3.3.4. Moisture content data

6.2. The system must include a document numbering and inventory procedure.

6.2.1. Assignment of accountable numbers to laboratory-generated data.

6.2.1.1. Each document of a case is inventoried and assigned a serialized number.
6.2.1.2. All documents pertaining to each case including, but not limited to, the following will be numbered and inventoried:

6.2.1.2.1. Sample traffic records, weekly reports.
6.2.1.2.2. Custody records, airbills, internal custody records.
6.2.1.2.3. Laboratory logbooks, personal logbooks, instrument logbooks, benchsheets.

6.2.1.2.4. Laboratory data (sorted by sample), calibration and quality control results.

6.2.1.2.5. Data summaries and reports.

6.2.1.2.6. All other documents, forms, or records referencing the samples. (The laboratory's name and/or logo should appear on all forms.)

6.2.2. Preparation of a document inventory

6.2.2.1. A document inventory list provides a record of all documents, and their corresponding document numbers, that are included in the completed case file.

6.2.2.2. A separate document inventory list (See example in Figure 8) is prepared for each case.

6.2.2.3. The laboratory will retain copies of the document inventory lists for case files purged to NEIC.

6.2.2.4. The number of documents for each case must be recorded.

7. STANDARD OPERATING PROCEDURES FOR HANDLING CONFIDENTIAL DOCUMENTS

7.1. All documents received with a group of samples and/or generated in the course of their analysis shall be kept confidential. Standard Business Records Confidentiality practices shall apply.

7.2. Documents specifically marked CONFIDENTIAL that may accompany the samples, are to be treated separately from other case-related documents.

7.3. Procedures for handling documents marked CONFIDENTIAL:

7.3.1. Contact SMO to assure that receipt of these document(s) is correct and necessary for analysis of the samples. If not required for analysis, return as directed by SMO.

7.3.2. If the document(s) are necessary to execute the sample analyses, place the document(s) in a secure file separate from the regular files and under the control of a designated Document Control Officer (DCO). The DCO will keep this file of confidential documents secure at all times and only allow authorized personnel access on an as needed basis.

7.3.3. Receipt of confidential documentation, its use, duplication, and ultimate disposition shall be documented in a Confidential Document Log. Duplication of confidential documents shall be kept to a minimum and done with the concurrence of the Project Officer or his/her deputy.

7.3.4. The DCO shall remove and retain for one year the cover sheet of any confidential material disposed of and note the disposition in the Confidential Document Log. Disposal of confidential documents should be done at the direction of the EPA Project Manager and/or the EPA Contracting Officer.

8. STANDARD OPERATING PROCEDURES FOR DOCUMENT/DATA PACKAGE SHIPPING

8.1. The delivery schedule of data/documents will be as described in Exhibit B of the Statement of Work.

8.2. The shipping of data/documents will be documented. The information documented will include the following:

8.2.1. Date Shipped.
8.2.2. Addressee.
8.2.3. What was sent, including case number, if appropriate.
8.2.4. Method of shipment (Federal Express, UPS Overnight, First Class Mail, etc.).
8.2.5. Airbill or invoice number, if applicable.
8.2.6. By whom sent.

8.3. All data/documents shipped shall have custody seals placed so that opening the package will cause the seals to be broken.

8.4. The method used must assure delivery to each user (the Region, SMO, and EMSL) at the same time. In the event the packages cannot be shipped at the same time, priority shipping shall be given to the Region's data package.

8.5. A list of data/documents shipped should be retained.

8.6. The case files shall be purged in accordance with the schedule in Exhibit B of the statement of Work and these documents will be shipped as stated above.

9. EXAMPLE LABORATORY SAMPLE AND DOCUMENT FLOW

ACTIVITY	DOCUMENTS	PERSONNEL
Sample Receipt	Airbills, Receiving Reports, Chain-of-Custody Records, Sample Receipt Logs, Traffic Reports	Sample Custodian/Receiving Clerk
Transfer to Storage	Sample Control Records	Sample Custodian
Transfer for Preparation	Sample Control Records, Preparation Logs, Extraction Logs, Bench Sheets, Analysts' Notebook Pages	Sample Custodian/ Analyst
Preparation	Preparation Logs, Extraction Logs, Bench Sheets, Analysts' Notebook Pages	Analyst
Transfer to Storage	Sample Control Records, Preparation Logs, Bench Sheets, Extraction Logs, Analysts' Notebook Pages	Analyst/Sample Custodian

Transfer for Analysis	Sample Control Records	Sample Custodian/Analyst
Analysis	Instrument (Run) Logs, Printouts, Strip Charts, Spectra, Etc.	Analyst
	Analysis Data Sheets, Bench Sheets, Analysis Data Summaries, Analysts' Logbook Pages	
Data Review	Printouts, Strip Charts, Etc.	Reviewer
	Analysis Data Sheets, Analysis Data Summaries, Review Sheets, Analysts' Logbook Pages	
Assembly	Inventory Sheets	Document Control Officer
Data Package Shipping	Shipping/Mail Log	Document Control Officer/Mail Clerk
Case File (Purge) Shipping	Shipping/Mail Log	Document Control Officer/Mail Clerk

10. LABORATORY ANALYST SIGNATURE LIST

10.1. To enable EPA to identify analysts from their initials and/or signatures on laboratory case file documents, a signature list is maintained by the laboratory. The signature list contains the analysts' typed names and initials, written signature, and written initials. all laboratory personnel working on the project should sign the list.

COLUMBIA ANALYTICAL

Analyst Name	Initials	Written Name	Initials

10.2. Completed signature lists and periodically updated lists are forwarded to the National Enforcement Investigations Center (NEIC) at the following address:

NEIC
Contract Evidence Audit Team (CEAT-TechLaw)
12600 West Colfax, Suite C-310
Lakewood, CO 80215

11. Standard Operating Procedures For Cleaning of Glassware.

11.1. General Procedures.

11.1.1. Wash with hot soapy water (Liquinox or equivalent) and rinse with tap water.
11.1.2. Rinse several times with distilled water.
11.1.3. Allow to air dry.
11.1.4. Put glassware into designated storage.

11.2. Metals and Cyanide Glassware Procedure.

11.2.1. Follow steps 5.1.1 and 5.1.2 above.
11.2.2. Rinse glassware twice with 1:10 nitric acid.
11.2.3. Rinse glassware several times with deionized water.
11.2.4. Store in 0.1 N nitric acid.
11.2.5. Rinse with deionized water several times before use.

11.3. Special Precautions. The above are the general procedures used by the glasswashing personnel. For trace level work, it is the responsibility of the analyst to ensure his/her glassware is free from contamination. The analyst should rinse glassware as appropriate before beginning analysis.

12. Standard Operating Procedures for Traceability of Standards.

12.1. Keep a Written record of concentration date received, lot number and expiration date of all stock standards.

12.2. Keep a written record for all standards made in house to include: element/s, concentration, date made, expiration date and technician's name.
12.2.1. Label all working standards with information in 12.2.

Computer File Name: EPAPROC

Columbia Analytical Services, Inc.

1152 3rd Avenue • Longview, WA 98632 • (206) 577-7222

SAMPLE RECIPIENT: _____ WORK REQUEST # / / / / / /

CUSTOMER NAME AND ADDRESS	CUSTOMER BILLING ADDRESS

PROJECT NAME: _____ REPORT TO: _____

CUSTOMER PO # _____

DATE SAMPLES RECEIVED: _____

DATE RESULTS REQUIRED: _____

SAMPLE DESCRIPTION:	BOTTLES RECEIVED:

SPECIAL HANDLING INSTRUCTIONS:

TESTS REQUIRED:

1. _____	6. _____	11. _____	16. _____
2. _____	7. _____	12. _____	17. _____
3. _____	8. _____	13. _____	18. _____
4. _____	9. _____	14. _____	19. _____
5. _____	10. _____	15. _____	20. _____

LAB CODE	SAMPLE NAME	TEST TO BE PERFORMED

REFERENCES: _____ APPROVED BY: _____ DATE:

File Name:REQUEST.FRA

LAB CODE	SAMPLE NAME	TEST TO BE PERFORMED

REFERENCES:

APPROVED BY:

DATE:

File Name:REQUEST.FRA

Columbia Analytical Services, Inc.

1152 3rd Avenue • Longview, WA 98632 • (206) 577-7222

********** CHAIN OF CUSTODY **********

LABORATORY ANALYSIS REQUEST

DATE_____PAGE_____OF_____.

PROJECT_____#_____

CLIENT INFO. CONTACT_____PHONE #_____

ADDRESS_____SAMPLERS NAME_____

Sample Name	Date	Time	Lab Code	Type	Analysis Requested
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					

Relinquished by CAS, Inc.	Received by:
Signature	Signature
Printed Name	Printed Name
Firm	Firm
Date/Time	Date/Time

CAS 05/88 CHAINWK.SHT

Sweet-Edwards / EMCON, Inc.
Kelso, WA (206) 423-3580
Redmond, WA (206) 881-0415

Chain of Custody / Laboratory Analysis Request

DATE _____ PAGE _____ OF _____

PROJECT _____ #_____

CLIENT INFO.
CONTACT _____

ADDRESS _____

TELEPHONE# _____

SAMPLERS NAME _____ PHONE# _____

SAMPLERS SIGNATURE _____

SAMPLE I.D.	DATE	TIME	LAB I.D.	TYPE
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				

ANALYSIS REQUESTED

GENERAL CHEMISTRY (Specify)

OTHER (Specify)

BASE/NEU/ACID ORGAN. GC/MS/625/8270	VOLATILE ORGANICS GC/MS/624/8240	HALOGENATED VOLATILE ORGANICS 601/8010	PHENOLICS 604/8040	POLYNUCLEAR AROMATIC 610/8310	TOTAL ORGANIC CARBON (TOC) 415/9060	TOTAL ORGANIC HALIDE (TOX) 9020	EP TOX/TCLP METALS (Circle One)	METALS (TOTAL) (See Special Inst.)	TCLP ORGANICS	pH, COND ALK	NO_3/NO_2, Cl SO_4	Ca, Mg, Na, K							NUMBER OF CONTAINERS

Relinquished By Sweet, Edwards & Assoc.
Signature
Printed Name
Firm
Date/Time

Relinquished By
Signature
Printed Name
Firm
Date/Time

Relinquished By
Signature
Printed Name
Firm
Date/Time

PROJECT INFORMATION
Shipping I.D. No.
VIA
Project

SAMPLE RECEIPT
Total No. of Containers
Chain of Custody Seals
Received in good condition
LAB NO.

Received By
Signature
Printed Name
Firm
Date/Time

Received By
Signature
Printed Name
Firm
Date/Time

Received By
Signature
Printed Name
Firm
Date/Time

SPECIAL INSTRUCTIONS/COMMENTS

TABLE II.—REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Parameter No./name	Container [1]	Preservation [2,3]	Maximum holding time [4]
Table IA—Bacterial Tests:			
1–4. Coliform, fecal and total	P, G	Cool, 4°C, 0.008% $Na_2S_2O_3$ [5]	6 hours.
5. Fecal streptococci	P, G	do	6 hours.
Table IB—Inorganic Tests:			
1. Acidity	P, G	Cool, 4°C	14 days.
2. Alkalinity	P, G	do	Do.
4. Ammonia	P, G	Cool, 4°C, H_2SO_4 to pH < 2	28 days.
9. Biochemical oxygen demand	P, G	Cool, 4°C	48 hours.
11. Bromide	P, G	None required	28 days.
14. Biochemical oxygen demand, carbonaceous	P, G	Cool, 4°C	48 hours.
15. Chemical oxygen demand	P, G	Cool, 4°C, H_2SO_4 to pH < 2	28 days.
16. Chloride	P, G	None required	Do.
17. Chlorine, total residual	P, G	do	Analyze immediately.
21. Color	P, G	Cool, 4°C	48 hours.
23–24. Cyanide, total and amenable to chlorination	P, G	Cool, 4°C, NaOH to pH > 12, 0.6g ascorbic acid [6]	14 days. [7]
25. Fluoride	P	None required	28 days.
27. Hardness	P, G	HNO_3 to pH < 2, H_2SO_4 to pH < 2	6 months.
28. Hydrogen ion (pH)	P, G	None required	Analyze immediately.
31, 43. Kjeldahl and organic nitrogen	P, G	Cool, 4°C, H_2SO_4 to pH < 2	28 days.
Metals: [8]			
18. Chromium VI	P, G	Cool, 4°C	24 hours.
35. Mercury	P, G	HNO_3 to pH < 2	28 days.
3, 5–8, 10, 12, 13, 19, 20, 22, 26, 29, 30, 32–34, 36, 37, 45, 47, 51, 52, 58–60, 62, 63, 70–72, 74, 75. Metals, except chromium VI and mercury.	P, G	do	6 months.
36. Nitrate	P, G	Cool, 4°C	48 hours.
39. Nitrate-nitrite	P, G	Cool, 4°C, H_2SO_4 to pH < 2	28 days.
40. Nitrite	P, G	Cool, 4°C	48 hours.
41. Oil and grease	G	Cool, 4°C, H_2SO_4 to pH < 2	28 days.
42. Organic carbon	P, G	Cool, 4°C, HCl or H_2SO_4 to pH < 2	Do.
44. Orthophosphate	P, G	Filter immediately, Cool, 4°C	48 hours.
46. Oxygen, Dissolved Probe	G Bottle and top	None required	Analyze immediately.
47. Winkler	do	Fix on site and store in dark	8 hours.
48. Phenols	G only	Cool, 4°C, H_2SO_4 to pH < 2	28 days.
49. Phosphorus (elemental)	G	Cool, 4°C	48 hours.
50. Phosphorus, total	P, G	Cool, 4°C, H_2SO_4 to pH < 2	28 days.
53. Residue, total	P, G	Cool, 4°C	7 days.
54. Residue, Filterable	P, G	do	48 hours.
55. Residue, Nonfilterable (TSS)	P, G	do	7 days.
56. Residue, Settleable	P, G	do	48 hours.
57. Residue, volatile	P, G	do	7 days.
61. Silica	P	do	28 days.
64. Specific conductance	P, G	do	Do.
65. Sulfate	P, G	do	Do.
66. Sulfide	P, G	Cool, 4°C add zinc acetate plus sodium hydroxide to pH > 9.	7 days.
67. Sulfite	P, G	None required	Analyze immediately.
68. Surfactants	P, G	Cool, 4°C	48 hours.
69. Temperature	P, G	None required	Analyze.
73. Turbidity	P, G	Cool, 4°C	48 hours.
Table IC—Organic Tests: [9]			
13, 18–20, 22, 24–28, 34–37, 39–43, 45–47, 56, 66, 68, 69, 82–85, 87. Purgeable Halocarbons.	G, Teflon-lined septum	Cool, 4°C, 0.008% $Na_2S_2O_3$ [5]	14 days.
6, 57, 90. Purgeable aromatic hydrocarbons	do	Cool, 4°C, 0.008% $Na_2S_2O_3$ [5], HCl to pH2 [10]	Do.
3, 4, Acrolein and acrylonitrile	do	Cool, 4°C, 0.008% $Na_2S_2O_3$ [5]; Adjust pH to 4–5 [10]	Do.
23, 30, 44, 48, 53, 67, 70, 71, 83, 85, 86. Phenols [11]	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$ [5]	7 days until extraction [12] 40 days after extraction.
7, 38. Benzidines [11]	do	do	7 days until extraction
14, 17, 48, 50–52. Phthalate esters [11]	do	Cool, 4°C	7 days until extraction 40 days after extraction.
72–74. Nitrosamines [11,13]	do	Cool, 4°C, store in dark, 0.008% $Na_2S_2O_3$ [5]	Do.
75–82. PCBs [11] acrylonitrile	do	Cool, 4°C	Do.
64, 65, 85, 89. Nitroaromatics and isophorone [11]	do	Cool, 4°C, 0.008% $Na_2S_2O_3$ [5] store in dark	Do.
1, 2, 5, 9–12, 32, 33, 58, 59, 84, 88, 84, 88. Polynuclear aromatic hydrocarbons, [11].	do	do	Do.
15, 16, 21, 31, 75. Haloethers [11]	do	Cool, 4°C, 0.008% $Na_2S_2O_3$ [5]	Do.
29, 35–37, 60–63, 91. Chlorinated hydrocarbons [11]	do	Cool, 4°C	Do.
87. TCDD [11]	do	Cool, 4°C, 0.008% $Na_2S_2O_3$ [5]	Do.
Table ID—Pesticides Tests:			
1–70. Pesticides [11]	do	Cool, 4°C, pH 5–9 [14]	Do.
Table IE—Radiological Tests:			
1–6. Alpha, beta and radium	P, G	HNO_3 to pH < 2	6 months.

[1] Polyethylene (P) or Glass (G).

[2] Sample preservation should be performed immediately upon sample collection. For composite chemical samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.

[3] When any sample is to be shipped by common carrier or sent through the United States Mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements of Table II, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid (HCl) in water solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).

[4] Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer time, and has received a variance from the Regional Administrator under § 136.3(e). Some samples may not be stable for the maximum time period given in the table. A permittee, or monitoring laboratory, is obligated to hold the sample for a shorter time if knowledge exists to show that this is necessary to maintain sample stability. See § 136.3(e) for details.

[5] Should only be used in the presence of residual chlorine.

[6] Maximum holding time is 24 hours when sulfide is present. Optionally all samples may be tested with lead acetate paper before pH adjustments in order to determine if sulfide is present. If sulfide is present it can be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12.

[7] Samples should be filtered immediately on-site before adding preservative for dissolved metals.

[8] Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.

[9] Sample receiving no pH adjustment must be analyzed within seven days of sampling.

[10] The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.

[11] When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to 4°C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6–9; samples preserved in this manner may be held for seven days before extraction and for forty days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (re the requirement for thiosulfate reduction of residual chlorine), and footnotes 12, 13 (re the analysis of benzidine).

[12] If 1,2-diphenylhydrazine is likely to be present, adjust the pH of the sample to 4.0 ± 0.2 to prevent rearrangement to benzidine.

[13] Extracts may be stored up to 7 days before analysis if storage is conducted under an inert (oxidant-free) atmosphere.

[14] For the analysis of diphenylnitrosamine add 0.008% $Na_2S_2O_3$ and adjust pH to 7–10 with NaOH within 24 hours of sampling.

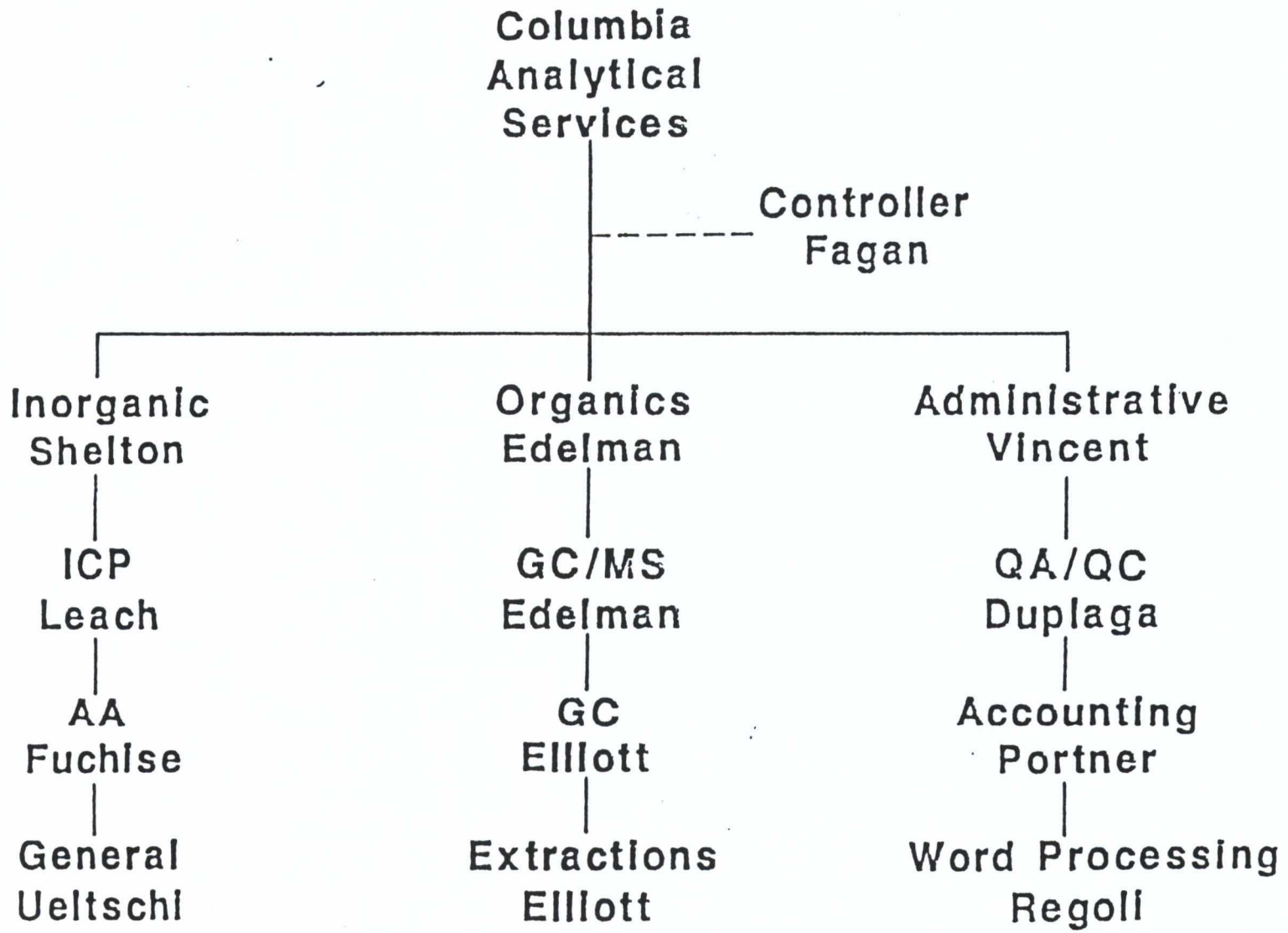
[15] The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $Na_2S_2O_3$.

APPENDIX 4.2

RESUMES OF

KEY PERSONNEL

PERSONNEL AND ORGANIZATION



RESUME OF STEPHEN W. VINCENT

Current Position: Manager/Chemist, Columbia Analytical Services. Responsible for all phases of lab operations including project planning, budgeting, quality assurance, etc.

Education:

1974	University of Washington, BS Oceanography.
1977	Portland State University, Graduate course in environmental chemistry.
1981	University of California at Los Angelas, Graduate School of Business Engineering and Management Program.
1984	University of Washington, completion of course work for MS Pulp and Paper Technology.

Experience:

1975-79 Analytical Chemist, Weyerhaeuser Company.
Responsibilities: Include method development, routine analysis and supervision for the Weyerhaeuser Multi-Region Support Lab. Responsible for setting up a company wide lab audit, round robin and quality assurance program.

1979-86 Lab Manager, Weyerhaeuser Company.
Responsibilities: All phases of lab management for organic, inorganic and microbiological analyses. This included management of capital and an annual operating budget of around two million dollars; management of a staff of around thirty employees; contract procruement and project management. Projects included an EPA Inorganic CLP contract; an EPA Acid Rain Deposition contract; a contract with the Fish and Wildlife Service to measure trace organic contaminants in animal tissues; and others.

Publications/ Presentations:

1981	"The Impact of Pulp and Paper Effluents on the Water Quality of the Lower Columbia river," with W. G. Hines and S. R. Young. TAPPI Environmental Conference, New Orleans, Louisiana, April 1981.
1977	"Weyerhaeuser Company's Effluent Monitoring Program for Toxic Metals," National council for Air and Stream Improvement, Portland, OR, 1977.
1981	"Weyerhaeuser Company's Corporate Quality Assurance Program," NCASI, New Orleans, Louisiana, June 1981.
1982	"Basic Laboratory Skills," NCASI Central Lakes Meeting, Chicage, 1982.

Affiliations:

American Chemical Society
Technical Association of the Pulp and Paper Industry

RESUME OF MICHAEL I. SHELTON

Current Position: Lead Chemist, Inorganic Section. Columbia Analytical Services. Responsible for operation of the inorganic section, including wet chemistry, AA and ICP labs. This includes employee supervision, methods development and quality assurance activities.

Education:

1970	Lower Columbia College, AA Chemistry.
1980	Green River College.
1976, 79	Jarrel-Ash Emission Spectroscopy Schools.
1981, 84, 86	AOAC Workshops in Analytical Chemistry.
1980, 84, 86	International Conference on Plasma Spectrochemistry.

Work Experience:

1970-79	Supervised Weyerhaeuser's water analysis lab. Developed and performed wet chemistry and instrumental methods. Set up atomic absorption and emission spectrometers for aqueous and solid sampling.
1979-82	Weyerhaeuser Metals Analysis Lab. Purchased and developed procedures for a JA 975 ICP spectrometer. Analyzed water, wastewater, soils, sediments and tissues for trace metals using AA and ICP techniques. Directed Weyerhaeuser's RCRA solid waste analytical program.
1982-86	Section Leader. Weyerhaeuser Elemental Analysis Laboratory. Supervised laboratory that included ICP, AA, ion chromatography, and other areas of inorganic chemistry. Project leader for EPA Inorganic CLP Project.

Publications/ Presentations:

1987	"Analysis of As, Se, Tl and Pb using GFAA with Palladium Modifier," EPA Inorganic Caucus, Washington D.C., February 1987.
1986	"ICP Selection Criteria," with Robert Botto. Course taught at International Conference on Plasma Spectrochemistry, Hawaii, 1986.
1984	"Analysis of Pulping Liquor by ICP Emission" Plasma Winter Conference, San Diego, CA, 1984
1984	"Modification of ICP for Sulfur Determinations in Black Liquors," Plasma Winter Conference, 1984.
1982	"Total Dissolution Analysis by ICP," Pacific Northwest ICP Workshop, Seattle, 1982.

Affiliations:

Society of Applied Spectroscopy
Association of Official Analytical Chemists.

RESUME OF DAVID L. EDELMAN, Ph.D.,CPC

Current Position: Lead Chemist, GC/MS Section. Columbia Analytical Services, Inc. Longview, WA.

Responsible for operating/managing the GC/MS section to produce high quality, cost-effective, timely analytical services to comply with federal RCRA, NPDES, CERCLA, SDWA, and State Regulatory requirements.

Education:

1973	University of Washington, B.S., Chemistry
1976	University of Washington, M.S., Organic Chemistry
1979	University of Washington, Ph.D., Forest Resources

Experience:

1986-88 James River Corporation Environmental Services. Laboratory Manager. Responsible for managing laboratory operations utilizing GC/MS/DS, ICAP, AA, TOC, GC/FID/ECD/TCD, UV/VIS, and Bioassay techniques on effluents, sludges, wastes, groundwater, and process streams. Responsible for obtaining accreditations from three (3) state regulatory agencies.

1979-86 Crown Zellerbach Corporation Environmental Services. Laboratory Coordinator. Performed/supervised sampling analytical services for RCRA Remedial Investigation Feasibility Studies, NPDES Permits, groundwater contamination studies, and solid waste disposal sites investigations. Developed specialized skills for analyzing materials from pulp/paper/packing industry.

Presentations:

1986	"EPA Method 200.7 For Trace Metals Analysis" AOAC National Meeting, Seattle, WA.
1986	"Chemical Analysis of Wastes For RCRA Compliance" Mt. Hood Community College Seminar, Portland, OR.
1984	"Drinking Water Certification Using ICAP Techniques" AOAC Regional Meeting, Olympia, WA.
1983	"Herbicide Application Watershed Monitoring Program" NCASI Regional Meeting, Portland, OR.
1982	"Sitosterol And Quercetin 3-Galactoside, Obscure Root Weevil Feeding Stimulants From Rhododendron" -with R.P. Doss, R. Luthi, and B.F. Hrutfiord.
1978	"Phenol Formaldehyde Adducts of Lignin Sufonates" ACS Regional Meeting, Portland, OR>

Affiliations:

American Chemical Society.
Association of Official Analytical Chemists
Technical Association of the Pulp and Paper Industry
Certified Professional Chemist
Standard Methods Committees Participation

RESUME OF THOMAS C. LEACH

Current Position:

Chemist, Columbia Analytical Services, Inc., Longview, WA.

Responsible for laboratory sample analysis mainly involving ICP methods, also including AA flame, hydride, cold vapor, and graphite furnace techniques as well as general wet chemistry and colorimetric techniques.

Education:

1970 B.A. in chemistry, Kalamazoo College, Kalamazoo, Michigan, 1970.

Experience:

1986-87 Weyerhaeuser Company, Tacoma, WA 1986-1987. Eighteen months ICP analytical applications. Six months graphite and flame AA analysis plus ion chromatography and wet chemistry responsibilities. Main metals analyst for EPA Acid Rain Deposition Survey contract held by Weyerhaeuser. Performed metals analysis on EPA CLP samples.

1981-86 Laucks Testing Laboratories, Seattle, WA 1981-1986. Four years AA flame, graphite furnace and gaseous hydride application. As well as general wet chemistry and colorimetric analysis.

1974-80 American Smelting & Refining Company, Tacoma, WA 1974-1980. Atomic absorption spectroscopy and wet chemistry methods for contract settlements, plant quality control, and environmental monitoring.

Membership:

American Chemical Society
Association of Official Analytical Chemists

RESUME OF CAROL DUPLAGA

Current Position: Chemist, Columbia Analytical Services, Inc. Longview, WA.

Duties include project management for landfill/groundwater chemical analysis projects, quality assurance program and safety program management, and routine wet chemistry measurements.

Education:

1968 Kent State University. B.S. Biology, 1968.

1983 Department of Army Management Training School, Madigan Hospital, Fort Lewis, WA, 1983.

Experience:

1969-76 Supervising Laboratory Technologist. San Diego County Lab, Veterinary Division. Performed and supervised microbiology and other clinical laboratory procedures. Supervision of four technicians.

1977-84 Supervisor, Stat Chemistry Lab. Madigan Hospital, Fort Lewis, WA. Supervised a stat lab for a 500 bed hospital. This involved the supervision and training of thirteen people. Instrumentation used at the lab included auto-analyzers, titrators, flame photometers, gas chromatographs and thin layer chromatography systems. Responsible for quality control, operating budgets and safety.

1986-87 Medical Technologist, Multnomah County Health Department. Performed clinical testing, microscopy examinations and water chemistries.

Presentations:

1982 "Stat Drug Analysis" 1982, Madigan Hospital. Presentation to staff doctors and lab personnel describing drug screening for in-coming emergencies.

1983 "Blood Gas Analysis" 1983, Madigan Hospital. Presentation made to medical lab staff concerning the procedures, instrument maintenance and quality control involved with the use of blood gas analyzers.

Affiliations:

American Society of Clinical Pathologists. Registered medical technologist.

American Association of Bioanalysts.

American Chemical Society.

RESUME OF TERRY W. HOPKINS

Current Position: Analytical Chemist, Columbia Analytical Services. Responsible for operation and maintenance of instrumentation for volatile organics analysis. This includes techniques such as 601/602, 8010/8020, BTEX and analysis of air monitoring samples for solvents. Additional responsibilities include bulk identification and fiber counting for asbestos analysis.

Education:

1969 Washington State University, BS Chemistry.

1987 Identification of Asbestos in Bulk Samples by Polarized Light Microscopy; MicroLab Northwest, Seattle, WA.

1988 NIOSH 582-Sampling and Evaluating Airborne Asbestos Dust; University of Washington, Seattle, WA.

Work Experience:

1969-70 Laboratory Analyst, Weyerhaeuser Pulp Analytical Laboratory, Longview, WA. Performed routine chemical analysis associated with the paper pulping process.

1970-87 Plant Chemist, Weyerhaeuser Chlorine Plant, Longview, WA. Lab supervisor of the chlorine plant lab included developing and set-up of test procedures, including autoanalyzers (Technicon), atomic absorption, gas chromatography and others. Supervision of lab personnel. Performing environmental and industrial hygiene monitoring programs around the plant site. Provide information on process parameters to operations.

1987-88 Analytical Chemist, Columbia Analytical Services. Responsible for routine inorganic chemical analyses in the water chemistry laboratory. Responsible for asbestos identification and asbestos fiber counting. Responsible for operation of purge and trap, GC, and data system for volatile organics analysis. Also responsible for performing routine sample prep. extraction, and set-up for analysis by Gas Chromatography.

RESUME OF EILEEN ARNOLD

Current Position: Chemist, Columbia Analytical Services, Inc.

Responsible for laboratory sample analysis involving ICP and other types of analyses.

Education:

1977 BA Chemistry, Immaculata College, Immaculata, PA.

Experience:

1986-87 Dow Corning Corporation, Springfield, OR. ICP and atomic absorption experience dealing with silicon manufacturing. Methods development for ICP analysis of minor impurities found in silicon.

1982-85 Ametek, Inc. Harleysville, PA. Product research and development chemist involved in production of thin-film semiconductors for use as solar cells. Work with AA and SEM techniques.

Janbridge, Inc. Philadelphia, PA. Maintain electroplating process lines through wet chemical analysis techniques and destructive testing of printed circuit boards.

RESUME OF JERRY UELTSCHI

Current Position: Chemist I, Columbia Analytical Services, Inc., Longview, WA.

Duties include routine chemical analysis in the inorganic section of the laboratory.

Education:

1977 — University of Oregon Health Sciences Center, School of Medicine, B.S. Medical Technology, 1977

1972 — University of Portland, B.S. General Science, 1972

Experience:

1971-77 — U.S. Army Reserve, First Aid Instructor, NCO in charge of First Aid Instructors' Group

1972-76 — Laboratory Assistant I & II, University of Oregon Health Sciences Center. Performed routine clerical duties and phlebotomy. Supervision of inpatient phlebotomy team.

1977-87 — Medical Technologist, Ocean Beach Hospital, Ilwaco, WA. Clinical analysis in the Chemistry, Hematology, Microbiology and Blood Banking areas of the laboratory. Supervisor of laboratory for eight years maintaining laboratory equipment and supplies. Responsible for: the quality control and quality assurance of the laboratory, performing the tests and supervising lab personnel. Member of Portland Red Cross Advisory Committee, 1984 to 1986.

Affiliations:

American Society of Clinical Pathologists. Medical Technologist, 1977 to present.

American Society of Microbiology, 1979 to 1982.

RESUME OF VIVIAN FUCHISE

Current Position: Chemist, Columbia Analytical Services, Inc. Longview, WA.

Responsible for laboratory sample analysis primarily with atomic absorption techniques including flame, flameless and graphite furnace methodologies.

Education:

1987 B.S. Chemistry, University of Oregon, June 1987

Experience:

1986 University of Oregon, 1986. Research Assistant. Investigations involved the use of micelles to solubilize organometallic complexes.

Publications:

"Reduction of Water Soluble Substrates in Micellar Solutions Using Photochemically Generated Nineteen-Electron Organometallic Complexes," with David Tyler. Published January 1988, Royal Society of Chemistry, Chemical Communications.

"Does Palladium Modifier For GFAA Offer Any Real Advantage?" The 1988 Association of Official Analytical Chemists Pacific Northwest Regional Section Meeting, June 1988, The Evergreen State College.

RESUME OF CHARLES WORLEY

Current Position: Chemist, Columbia Analytical Services, Inc. Longview, WA.

Present duties include sample preparation and digestion with analysis of same by atomic absorption flame and graphite furnace technique.

Education:

1973	Portland State University, B.S. Chemistry
1974	Portland State University, Certificate Public Health Studies

Experience:

1962-78	Analytical Chemist, Weyerhaeuser Research Division. Duties included training, analysis of many sample types using a wide variety of wet chemical techniques including atomic absorbtion, emission, IR, UV-VIS spectroscopy, gas chromatography, and other analytical procedures.
1978-87	Analytical lab leader, Boise Cascade Pulp and Paper R & D. Responsible for lab service to company facilities, including environmental, industrial hygiene, and hazardous waste testing. Responsible for capital equipment additions, lab personnel training and service as acting safety coordinator.

Presentations:

1987	"Right-to-Know" Law training presentation Boise Cascade Pulp and Paper Research and Development

Affiliations:

American Chemical Society

Technical Association of Pulp and Paper Industries

Society for Applied Spectroscopy

RESUME OF BRIAN JOHNSON

Current Position: Chemist, Columbia Analytical Services, Inc. Longview, WA.

Duties include trace metal analysis of soils and water by atomic absorption spectroscopy and anion analysis by Liquid Ion Chromatography.

Education:

1985	Portland State University. B.S. Chemistry, 1985.
1986	Varian Instruments, Walnut Creek, CA., H.P.L.C. Training Course.
1987	Northrop Corporation, Pico River, CA., Effective Speaking Course.

Experience:

1983-84	Undergraduate Research Assistant, Carl Wamser, Portland State University. Duties included polymer membrane synthesis and instrument maintenance.
1986-88	Engineer I, Northrop Advanced Systems Division, Pico Rivera, CA., Performed instrumental analysis of polymer composites by HPLC, GC, and AA.

Presentations:

1988	"Moisture Content of Polyamide, Bismaleimide, and Phenolic Resins and Prepregs by Gas Chromatography or by Karl Fischer Titration." Presented to Engineers and Management for technical reference.

APPENDIX 4.3

QA/QC ACCEPTANCE LEVELS

FOR SPIKE RECOVERIES

MATRIX SPIKE RECOVERY TABLES

The following tables provide spike recovery information for EPA SW 846 Methods performed at CAS.

A matrix spike and duplicate is run with the set of samples analyzed during the day or every 10 samples, whichever is more frequent. As part of the certification process for California, the percent recovery control limits are continually monitored and updated quarterly based on the previous 3-month weight averaging of all recovery data for each matrix analyzed. A minimum of 20 matrix spikes must be processed before control limits are changed.

All spiked samples that exceed control limits are re-analyzed with a blank spike. The blank spike serves to verify that the analytical system is still in control and that the out-lying recovery data are matrix dependent. Based on the blank spike data, if the out-lying data are not matrix dependent, the entire system is judged out of control and steps are taken to correct and recalibrate the system. All samples affected will be re-analyzed to verify the accuracy of the data.

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TABLE 1

EPA METHOD 8010 CONTROL LIMITS

COMPOUND	CONTROL LIMITS FOR ACCEPTABLE SPIKE PERCENT RECOVERY	
	Water	Soil/Sediment
Bromodichloromethane	80-120	70-130
Bromoform	80-120	70-130
Bromomethane	70-130	60-140
Carbon Tetrachloride	60-130	50-140
Chlorobenzene	80-120	70-130
Chloroethane	70-130	60-140
Chloroform	80-120	70-130
2-Chloroethyl vinyl ether	50-150	40-160
Chloromethane	60-140	50-150
Dibromochloromethane	80-120	70-130
1,2 Dichlorobenzene	80-120	70-130
1,3 Dichlorobenzene	80-120	70-130
1,4 Dichlorobenzene	80-120	70-130
1,1-Dichloroethane	80-120	70-130
1,2-Dichloroethane	80-120	70-130
1,1-Dichloroethylene	80-120	70-130
Trans 1,2-Dichloroethylene	80-120	70-130
Dichloromethane	70-130	60-140
1,2-Dichloropropane	80-120	70-130
Trans 1,3-Dichloropropylene	80-120	70-130
1,1,2,2-Tetrachloroethane	80-120	70-130
Tetrachloroethylene	80-120	70-130
1,1,1-Trichloroethane	50-120	40-130
1,1,2-Trichloroethane	80-120	70-130
Trichloroethylene	80-120	70-130
Trichlorofluoromethane	80-120	70-130
Vinyl Chloride	70-130	60-140

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TABLE 2

EPA METHOD 8020 CONTROL LIMITS

COMPOUND	CONTROL LIMITS FOR ACCEPTABLE SPIKE PERCENT RECOVERY	
	Water	Soil/Sediment
Benzene	80-120	70-130
Chlorobenzene	80-120	70-130
1,4-Dichlorobenzene	80-120	70-130
1,3-Dichlorobenzene	80-120	70-130
1,2-Dichlorobenzene	80-120	70-130
Ethyl Benzene	80-120	70-130
Toluene	80-120	70-130
Xylenes	80-120	70-130

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TABLE 3

EPA METHODS 3500 SERIES/8040 CONTROL LIMITS

PARAMETER	CONTROL LIMITS FOR ACCEPTABLE SPIKE PERCENT RECOVERY	
	Water	Soil/Sediment
4-Chloro-3-methylphenol	80-120	80-120
2-Chlorophenol	40-130	40-130
2,4-Dichlorophenol	40-100	40-100
2,4-Dimethylphenol	40-100	40-100
4,6-Dinitro-2-methylphenol	30-120	30-120
2,4-Dinitrophenol	20-100	20-100
2-Nitrophenol	50-110	50-110
4-Nitrophenol	20-100	20-100
Pentachlorophenol	50-110	50-110
Phenol	20-80	20-80
2,4,6-Trichlorophenol	50-100	50-100

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TABLE 4

EPA METHODS 3500 SERIES/8080 CONTROL LIMITS

COMPOUND	CONTROL LIMITS FOR ACCEPTABLE SPIKE PERCENT RECOVERY	
	Water	Soil/Sediment
Aldrin	60-110	50-100
-BHC	40-110	40-110
-BHC	30-120	30-120
-BHC	30-120	30-120
-BHC (Lindane)	40-100	40-100
Chlordane (technical)	50-110	50-110
4,4'-DDD	40-120	40-120
4,4'-DDE	40-120	40-120
4,4'-DDT	40-120	40-120
Dieldrin	50-110	50-110
Endosulfan I	50-110	50-110
Endosulfan II	30-120	30-120
Endosulfan sulfate	60-110	60-110
Endrin	30-120	30-120
Endrin aldehyde	30-120	30-120
Heptachlor	60-110	50-110
Heptachlor epoxide	60-110	50-110
Methoxychlor	60-110	50-110
Toxaphene	60-110	50-110
PCB-1016	60-110	60-110
PCB-1221	60-110	60-110
PCB-1232	60-110	60-110
PCB-1242	60-110	60-110
PCB-1248	60-110	60-110
PCB-1254	60-110	60-110
PCB-1260	60-110	60-110

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TABLE 5

EPA METHODS 3500 SERIES/8100 CONTROL LIMITS

PARAMETER	CONTROL LIMITS FOR ACCEPTABLE SPIKE PERCENT RECOVERY	
	Water	Soil/Sediment
Acenaphthene	60-110	60-110
Acenaphthylene	60-110	60-110
Anthracene	50-110	50-110
Benzo(a)anthracene	60-110	60-110
Benzo(a)pyrene	60-110	60-110
Benzo(b)fluoranthene	50-100	50-100
Benzo(ghi)perylene	40-90	40-90
Benzo(k)fluoranthene	50-110	50-110
Chrysene	50-110	50-110
Dibenzo(a,h)anthracene	60-110	60-110
Fluoranthene	60-110	60-110
Fluorene	75-110	75-110
Indeno(1,2,3-cd)pyrene	50-100	50-100
Naphthalene	75-110	75-110
Phenanthrene	60-110	60-110
Pyrene	60-110	60-110

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TABLE 6

EPA METHODS 3500 SERIES/8120 CONTROL LIMITS

PARAMETER	CONTROL LIMITS FOR ACCEPTABLE SPIKE PERCENT RECOVERY	
	Water	Soil/Sediment
2-Chloronaphthalene	70-110	70-110
1,2-Dichlorobenzene	60-110	60-110
1,3-Dichlorobenzene	60-110	60-110
1,4-Dichlorobenzene	60-110	60-110
Hexachlorobutadiene	50-100	50-100
Hexachlorocyclopentadiene	20-70	20-70
Hexachloroethane	50-100	50-100
1,2,4-Trichlorobenzene	60-110	60-110

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TABLE 7

EPA METHOD 8150 CONTROL LIMITS

PARAMETER	CONTROL LIMITS FOR ACCEPTABLE SPIKE PERCENT RECOVERY	
	Water	Soil/Sediment
2,4-D	60-110	50-100
2,4-DB	70-120	60-110
2,4,5-T	70-120	60-110
2,4,5-TP (Silvex)	70-120	60-110
Dalapon	40-100	40-100
Dicamba	60-110	60-110
Dichloroprop	80-120	70-110
Dinoseb	60-110	60-110
MCPA	80-120	70-130
MCPP	70-110	60-110

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TABLE 8
EPA METHOD 8240 CONTROL LIMITS

PARAMETER	CAS Number	CONTROL LIMITS FOR ACCEPTABLE SPIKE PERCENT RECOVERY	
		Water	Soil/Sediment
1. Chloromethane	74-87-3	60-140	50-150
2. Bromomethane	74-83-9	60-140	50-150
3. Vinyl Chloride	75-01-4	60-140	50-150
4. Chloroethane	75-00-3	70-130	60-140
5. Methylene Chloride	75-09-2	70-130	60-140
6. Acetone	67-64-1	60-140	50-150
7. Carbon Disulfide	75-15-0	75-125	60-140
8. 1,1-Dichloroethene	75-35-4	75-125	60-140
9. 1,1-Dichloroethane	75-35-3	75-125	60-140
10. trans-1,2-Dichloroethene	156-60-5	75-125	60-140
11. Chloroform	67-66-3	75-125	60-140
12. 1,2-Dichloroethane	107-06-2	75-125	60-140
13. 2-Butane	78-93-3	75-125	60-140
14. 1,1,1-Trichloroethane	71-55-6	80-120	75-125
15. Carbon Tetrachloride	56-23-5	80-120	75-125
16. Vinyl Acetate	108-05-4	60-140	50-150
17. Bromodichloromethane	75-27-4	80-120	75-125
18. 1,1,2,2-Tetrachloroethane	79-34-5	80-120	75-125
19. 1,2-Dichloropropane	78-87-5	80-120	75-125
20. trans-1,3-Dichloropropene	10061-02-6	80-120	75-125
21. Trichloroethene	79-01-6	80-120	75-125
22. Dibromochloromethane	124-48-1	80-120	75-125
23. 1,1,2-Trichloroethane	79-00-5	80-120	75-125
24. Benzene	71-43-2	80-120	75-125
25. cis-1,3-Dichloropropene	10061-01-5	80-120	75-125
26. 2-Chloroethyl Vinyl Ether	100-75-8	50-150	40-160
27. Bromoform	75-25-2	80-120	75-125
28. 2-Hexanone	591-78-6	80-120	75-125
29. 4-Methyl-2-pentanone	108-10-1	80-120	75-125
30. Tetrachloroethene	127-18-4	80-120	75-125
31. Toluene	108-88-3	80-120	75-125
32. Chlorobenzene	108-90-7	80-120	75-125
33. Ethyl Benzene	100-41-4	80-120	75-125
34. Styrene	100-42-5	80-120	75-125
35. Total Xylenes	100-42-5	80-120	75-125

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TABLE 9

EPA METHODS 3500 SERIES/8270 CONTROL LIMITS

Semivolatiles	CAS Number	CONTROL LIMITS FOR ACCEPTABLE SPIKE PERCENT RECOVERY Water	Soil/Sediment
2,6-Dinitrotoluene	606-20-2	80-120	70-110
Diethylphthalate	84-66-2	30-80	30-80
4-Chlorophenyl phenyl ether	7005-72-3	80-120	70-110
Fluorene	86-73-7	60-110	60-110
4,6-Dinitro-2-methylphenol	534-52-1	50-100	50-100
N-Nitrosodiphenylamine	86-30-6	60-110	60-110
4-Bromophenyl phenyl ether	101-55-3	80-120	80-120
Hexachlorobenzene	118-74-1	50-90	50-90
Pentachlorophenol	87-86-5	60-110	60-110
Phenanthrene	85-01-8	60-110	60-110
Anthracene	120-12-7	50-100	50-100
Di-n-butylphthalate	84-74-2	40-80	40-80
Fluoranthene	206-44-0	40-80	40-80
Pyrene	129-00-0	50-100	50-100
Butyl benzyl phthalate	85-68-7	30-90	30-90
3,3'-Dichlorobenzidine	91-94-1	20-90	20-90
Benzo(a)anthracene	56-55-3	60-110	60-110
bis(2-ethylhexyl)phthalate	117-81-7	55-100	55-100
Chrysene	218-01-9	60-110	60-110
Di-n-octyl phthalate	117-84-0	60-110	60-110
Benzo(b)fluoranthene	205-99-2	60-110	60-110
Benzo(k)fluoranthene	207-08-9	60-110	60-110
Benzo(a)pyrene	50-32-8	60-110	60-110
Indeno(1,2,3-cd)pyrene	193-39-5	60-110	60-110
Dibenzo(a,h)anthracene	53-70-3	60-110	60-110
Benzo(g,h,i)perylene	191-24-2	60-110	60-110

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TABLE 9 (con't.)

EPA METHODS 3500 SERIES/8270 CONTROL LIMITS

Semivolatiles	CAS Number	CONTROL LIMITS FOR ACCEPTABLE SPIKE PERCENT RECOVERY Water	Soil/Sediment
Phenol	108-95-2	20-80	20-80
2-Chlorophenol	95-57-8	50-110	50-110
1,3-Dichlorobenzene	541-73-1	50-110	50-110
1,4-Dichlorobenzene	106-46-7	50-110	50-110
1,2-Dichlorobenzene	95-50-1	50-110	50-110
bis(2-Chloroisopropyl)ether	39638-32-9	70-130	70-130
N-Nitroso-Di-N-propylamine	621-64-7	40-140	40-140
Hexachloroethane	67-72-1	50-110	50-110
Nitrobenzene	98-95-3	60-110	60-110
Isophorone	78-59-1	60-110	60-110
2-Nitrophenol	88-75-5	50-100	50-100
2,4-Dimethylphenol	105-67-9	50-100	50-100
bis(2-Chloroethoxy)methane	111-91-1	50-120	50-120
2,4-Dichlorophenol	120-83-2	50-110	50-110
1,2,4-Trichlorobenzene	120-82-1	60-100	60-100
Naphthalene	91-20-3	80-120	80-120
Hexachlorobutadiene	87-68-3	40-100	40-100
4-Chloro-3-methylphenol	59-50-7	50-110	50-110
Hexachlorocyclopentadiene	77-47-4	20-70	20-70
2,4,6-Trichlorophenol	88-06-2	60-110	60-110
2,4,5-Trichlorophenol	95-95-4	60-110	60-110
2-Chloronaphthalene	91-58-7	50-110	50-110
Dimethyl phthalate	131-11-3	20-70	20-70
Acenaphthylene	208-96-8	60-110	60-110
Acenaphthene	83-32-9	60-110	60-110
2,4-Dinitrophenol	51-28-5	50-100	50-100
4-Nitrophenol	100-02-7	20-100	20-100
2,4-Dinitrotoluene	121-14-2	60-110	60-110

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TABLE 10

EPA TOXIC METALS/INORGANICS CONTROL LIMITS

Parameter	EPA Method	CONTROL LIMITS FOR ACCEPTABLE SPIKE PERCENT RECOVERY	
		Water	Soil/Sediment *
Antimony	6010	75-125	50-130
Arsenic	7060	75-125	60-130
Barium	6010	75-125	60-130
Beryllium	6010	75-125	60-130
Cadmium	6010	75-125	60-130
Chromium VI	7196	75-125	60-130
Chromium, Total	6010	75-125	60-130
Cobalt	6010	75-125	60-130
Copper	6010	75-125	60-130
Lead	7421	75-125	60-130
	6010	75-125	60-130
Mercury	7470	60-140	60-130
	7471	60-140	60-130
Molybdenum	6010	75-125	60-130
Nickel	6010	75-125	60-130
Selenium	7740	75-125	50-130
Silver	6010	75-125	50-130
Thallium	7841	75-125	60-130
Vanadium	6010	75-125	60-130
Zinc	6010	75-125	60-130
Cyanide	9010	75-125	60-130
Fluoride	340.2	75-125	60-130
Sulfide	9030	75-125	60-130

* = for homogeneous samples

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TABLE 11

CALIFORNIA SPECIFIC METHODS CONTROL LIMITS

Parameter	CONTROL LIMITS FOR ACCEPTABLE SPIKE PERCENT RECOVERY	
	Water	Soil/Sediment
Total Organic Lead	50-130	50-130
Total Petroleum Hydrocarbons	80-120	70-130

APPENDIX 4.4

INSTRUMENTATION AND EQUIPMENT

DETAILED DESCRIPTIONS

Sample Receiving and Storage (Sample Management)

* 6 Temperature Controlled Sample Coolers
* Leading Edge D2 Computer and LOTUS 1-2-3 Sample Management System

Inorganic/Metals Sample Preparation Area

* COD and Kjeldahl Digestion Systems
* Microwave Digestion System
* RCRA EP Toxicity Extractor
* 2 Hoods and Hot Plates

ICP Laboratory

* Jarrell Ash Model 61 simultanous emission spectrophotometer with 30 analytical channels

Inorganic/Metals Instrumentation Area

* Analytical Balances (Mettler HL 32,Mettler PE 106)
* UV/Visible Spectrophotometer (Hitachi 100-40 single beam)
* Infra-red Analyzer (Perkin Elmer 267 IR grating)
* 4 Atomic Absorption Spectrometer (Varian 20 AA with graphite furnace, auto-sampler, and hydride system; 2 Varian Spectra 30 Zeeman AAs and DS-15 data stations); Varian Spectra 10B flame AA.
* Chloride Analyzer (Haake Buchler digital chloride titrator)
* Ion Chromatograph (Dionex 2000i with 4270 Integrator)

* Specific Ion Meter (Orion 901 pH and selective ion electrode meter)

* pH Meter (Cole Palmer 5985-50 pH Meter)

* Conductivity Meter (Amber Science Model 604)

* 2 Drying Ovens (Shel-Lab Models 1370 F and 1350 F)

* Muffle Furnace (Thermolyne Model F-A1730)

* Autoclave (Sybron/Ritter Model 1000 Sterilizer)

* 4 Water Baths/Incubators (Hach Model 15320 Incubator, Precision Model L-6, Shel-Lab Model 1240, VWR 1500 E)

* Flash Point Tester (Precision Scientific Model 74537 Pensky-Martens Tester)

* Centrifuge (MSE GF-8 free standing laboratory centrifuge)

* Water Purification System, Aqua Media demineralizer/carbon/particulate filtration system.

* Turbidimeter (Hach)

* Calorimeter (Parr 1241 EA Adiabatic)

Organic Sample Preparation Area

* Soxhlet Extractor (Lab-line Multi-Unit Extraction Heater)

* Analytical Evaporator (N-Evap)

* 2 Hoods

Organic Instrumentation Area

* TOC Analyzer (Coulometrics 5010/5020 with liquid and solids capability)

* TOX Analyzer (Mitsubishi TOX-10 halogen analyzer)

* 4 Gas Chromatographs (2 Perkin-Elmer 8500 with as-8300 Autosampler and FID/ECD detectors; Varian 3300 GC with OI 4460 Purge and Trap Device/autosampler and PID/Hall detectors; and Hewlett Packard 5790 with FID/ECD and 7672A autosampler).

GC/MS Laboratory

* 2 Hewlett Packard 5890/5970 GC/MS Systems with HP-1000 Data System (RTE-A/Aquarius Software and NBS-Wiley Libraries), and Autosampler. Capable of capillary and packed column operation and equiped with OI-4460 Purge and Trap Device/Autosampler.

Office Area (Laboratory Management)

* 2 Computers (Kammerman AT and IBM PC for data handling/reporting and QA/QC procedures)

* SMART-LOG CLP Software (Telecations)

Appendix H

DATA MANAGEMENT

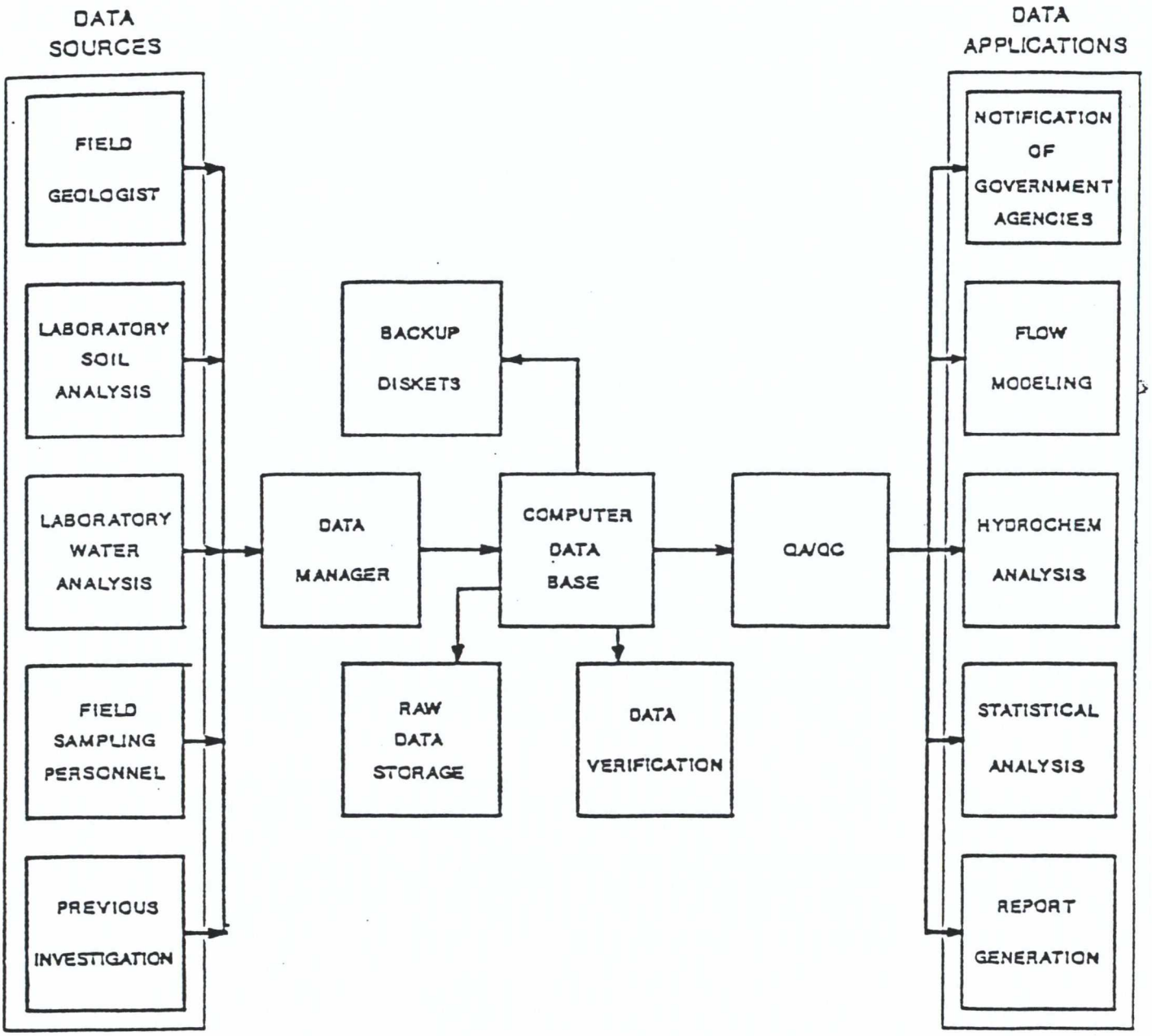
DATA MANAGEMENT

Sweet-Edwards/EMCON's data management plan for the Phase II Hydrogeologic Investigation, Pier 91 will consist of three elements: data sources, data processing and data applications. Personnel involved in data management include the field and laboratory personnel, project geologist, data manager and data user personnel. The data will be generated in the field, entered on a computer for general use and placed in long term storage (refer to following schematic flow diagram).

DATA SOURCES

The data sources include field geologist, laboratory soil and water analyses, field sampling and previous investigation. The raw field data will be in the form of boring logs, chain-of-custody forms, field sampling sheets, laboratory analysis reports and field notes (see previous Appendices for examples). The field geologist will generate boring logs, describing drilling results, and chain-of-custody forms for soil samples submitted for analyses. The information will be summarized on water quality, water level, aquifer testing, soil quality and construction data base. In addition, the field geologist and project geologist will interpret field data for aquifer hydraulic conductivity analysis. The results of the analysis will be summarized in a data base on aquifer characteristics.

The laboratory will report analysis of soil and water quality as concentration and will be summarized in a printed table. Raw data, consisting of peak height and other instrument readings, will be converted to concentrations by the laboratory. Information from the reports will be part of the soil chemistry data base and the water quality data base.



DATA MANAGEMENT FLOW CHART

DATA PROCESSING

Data processing elements of the data management plan include data management responsibilities, computer capabilities and QA/QC. The field personnel are responsible for collecting proper information and forwarding that information to the project geologist or data manager. The data manager will be responsible for the proper handling of the data and maintaining the data bases.

The computer used for data management purposes will be an IBM PC compatible. The data base will be Symphony (by Lotus). The data base will be stored on standard 5 1/4-inch mini-disks.

The QA/QC for data base management will consist of verification, data storage and documentation. Data base verification is a visual check of the data entries to assure correct consistencies in the data entry. Storage of the data base will be on two mini disks; a working copy and a back up held by the Data Manager. Once the data has been verified, the raw data forms will be held in long term storage by the project geologist. Documentation will be an updated copy of the data base print-out that will be available for review.

DATA APPLICATIONS

The data application element of the data management plan consists of all reports, graphics and generated documents. The applications include notification of government agencies, flow modeling, hydrochemistry application and statistical analysis, but should not be limited to only the application described.

Hydrochemistry application will help in assessing the horizontal and vertical distribution of contaminants and the long term disposition of contaminants. Information used in this

application includes water quality data, topographic data and geologic information. As part of the hydrochemical analysis, time series plots of the parameters will be made. Time series analysis may be useful in statical assessment and in model projection of migration and attenuation. Time series assessment will be particularly valuable in a contaminant capture evaluation.